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Strategic Environmental Assessment Report of the Integrated National Energy and Climate Plan of the Republic of Serbia (INECP)

for the period up to 2030 with a vision up to 2050

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ABBREVIATIONS AND ACRONYMS

AERS	Energy Agency of the Republic of Serbia
AFOLU	Agriculture, Forestry and Other Land Use
AL	Albania
ASEAN	Association of Southeast Asian Nations
BA	Bosnia and Herzegovina
BG	Bulgaria
BUR	Biennial update report
CACM	Capacity allocation and congestion management
CBAM	Carbon Limit Adjustment Mechanism
CBD	Convention on Biological Diversity
CCGT	Combined cycle power plant
CCUS	Carbon capture, storage and utilization
CECEC	Central and South-Eastern Europe Energy Connectivity
CEIP	Emission Inventories and Projections
CLRTAP	Convention on Long-range Transboundary Air Pollution
CEKOR	Center for Ecology and Sustainable Development
COP21	Paris Climate Conference
CP	Contracting party
DSO	Distributed system operator
EAP	Environmental Action Programme
EBRD	European Bank for Reconstruction and Development
EC	European Commission
EE	Energy efficiency
EEA	European Environmental Agency
EEFIG	Group of Financial Institutions for Energy Efficiency
EIA	Environmental Impact Assessment
EMEP	European Monitoring and Evaluation Programme
EnC	Energy Community
ENTSO-E	European Network of Transmission System Operators for Electricity
ENTSOG	European network of gas transmission system operators
EO	Environmental Objective
EPEX SPOT	European electricity exchange

EPS	Public company "Elektroprivreda Srbije"
ESCO	Energy service companies
Espoo	Convention on Environmental Impact Assessment in a Transboundary Context
ETS	Emissions trading system
EU	European Union
FBUR	First Biennial Update Report
FEC	Final energy consumption
GDP	Gross domestic product
GFEC	Gross final energy consumption
GHG	Greenhous Gas
GWP	Global warming potential
HR	Croatia
HPP	Hydro Power Plant
IAEA	International Atomic Energy Agency
IBA	Important Bird Area
ICT	Information and communication technologies
IFI	International financial institution
IMWG	Inter-Ministerial Working Group on SDGs
INC	Initial National Communication
INDC	Intended National Determined Contribution
INECP	Integrated National Energy and Climate Plan of the Republic of Serbia for the period up to 2030 with a vision up to 20 50
IPA	Important Plant Area
IPCC	Intergovernmental Panel on Climate Change
IPCMS	Institute for Protection of Cultural Monuments of Serbia
JCR	Joint Research Center
JSC	Stock company
LDV	Light truck
LEERUE	Law on energy efficiency and rational use of energy
LNG	Liquid natural gas
LULUCF	Land use, land use change and forestry
MaaS	Mobility as a service
MAPS	Mainstreaming, Acceleration and Policy Support
MC-EnC	Ministerial Council - Energy Community

MHPP	Micro-Hydro Power Plant
MK	North Macedonia
MN	Montenegro
MoCTI	Ministry of Construction, Transport and Infrastructure
MOME	Ministry of Mining and Energy
NC	National Communication
NECP	National energy and climate plan
NEEAP	National Energy Efficiency Action Plan
NIS	NIS ad Novi Sad
NMVOC	Non-Methane Volatile Organic Compound
NO	Appointed electricity market operators
NOW S	One coupling for the day ahead
NPAA	National Program for the Adoption of the Acquis
NPI	National Program for the Integration of the Republic of Serbia in the EU
NREAP	National action plan for renewable energy
NTC	Net transmission capacity
nZEB	Buildings with almost zero energy
O&M	Operation and maintenance
OHL	Overhead line
ORF-EE	Open regional fund for Southeast Europe - energy efficiency
PCI	A project of mutual interest
PF4EE	Private financing of energy efficiency
PM	Policy measure
RES	Renewable Energy Sources
RHPP	Reversible Hydro Power Plant
RIA	Rapid Integrated Assessment
RS	Republic of Serbia
RZS	Institute for Statistics of the Republic of Serbia
SAIDI	Average System Outage Duration Index
SAIFI	Average System Outage Frequency Index
SANU	Serbian Academy of Sciences and Arts
SEA	Strategic Environmental Assessment
SDGs	Sustainable Development Goals
SEE	Southeast Europe

SEEPEX	South-eastern European power exchange
SEO	Specific Environmental Objective
SESA	Strategic Environmental and Social Assessment
SET	Strategic energy technology
SIDMC	Single Intraday Market Coupling
SMATSA	Serbia and Montenegro Air Traffic Security Agency
SMEs	Small and medium-sized enterprises
SMR	Small modular reactors
SNC	Second National Communication
SPA	Special Protection Area
SPRS	Spatial Plan of the Republic of Serbia
SS	Outpost
SSP	Common socioeconomic paths
SWOI	Serbian Water Quality Index
TIDE	Project library and application for interactive maps
TPP	Thermal Power Plant
TRINITY	Improving the transmission system of regional borders using Intelligent Market Technology
TS	Transformer Substation
TSO	Transmission system operator
TINDP	Network development plan for teenagers
UN	United Nations
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
VAT	Value Added Tax
WAM	Scenario with additional measures
WEM	Scenario with existing measures
WG	Work group

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1 NON-TECHNICAL SUMMARY

1.1 THE SEA PROCESS

Strategic Environmental Assessment (SEA) is the formal, systematic evaluation of the likely significant environmental effects of implementing a plan or programme, or variation to a plan or programme before a decision is made to adopt it.

Regarding the development of the Integrated National Energy and Climate Plan of the Republic of Serbia for the period up to 2030 with a vision up to 2050 (hereinafter INECP), the strategic environmental impact assessment is a procedure that provides conditions for appropriate environmental and social protection. The report on the strategic impact assessment of the INECP is a document that describes, evaluates and assesses possible significant impacts on the environment and human that may occur through the implementation of the INCEP and which determines measures to reduce negative impacts.

The SEA report according to Article 12 of the Law on Strategic Impact Assessment contains the following chapters:

(1) Background information for the Strategic Environmental Assessment; (Chapter 3)

(2) General and specific objectives of Strategic Environmental Assessment and selection of indicators; (Chapter 4)

(3) Assessment of the potential environmental impacts and measures to reduce negative impacts on the environment; (Chapter 5)

(4) Guidelines for making strategic assessments at lower hierarchical levels and assessing the impact of projects on the environment; (Chapter 6)

(5) Environmental monitoring program during the implementation of the Strategy; (Chapter 7)

(6) Overview of the methodology and difficulties encountered; (Chapter 8)

(7) Decision-making methods; (Chapter 9)

(8) Overview of conclusions reached; (Chapter 10)

The Report also provides a comparative analysis of alternative scenarios that were considered during the preparation of the INECP; the scenario with existing measures (WEM) and the scenario with additional measures (WAM).

1.2 OVERVIEW OF PROPOSED STRATEGY

The process of drafting and preparing the Integrated National Energy and Climate Plan (INECP) was implemented within the project "Further Development of Energy Planning Capacity", which was launched in February 2021.

The proposed INECP has taken a holistic approach and deals in an integrated way with five closely related and mutually reinforcing areas of the Energy Union:

- **Decarbonisation**: a specific area reflecting the country's commitment to climate actions and decarbonisation of the economy, with a special focus on the increased use of renewable energy sources and the reduction of the carbon footprint.
    a. **Greenhouse Gas (GHG) Emissions:** A sub-area linked to the objective of reducing energy-related and non-energy-related emissions, in line with the country's commitments.
    b. **Renewable Energy Sources (RES):** the sub-area reflecting the country's commitment to boost the deployment of renewables by keeping up with increasing energy consumption and addressing the transformation issue of the existing energy system in terms of technology transition.
- **Energy efficiency**: a specific sub-area related to the aim of the country's commitment to increase energy efficiency across all sectors.
- **Energy security**: a specific area reflecting the country's commitment to the diversification of energy sources and ensuring security of supply through solidarity and cooperation between the EU and the Energy Community (EnC) countries.
- **Internal energy market**: a specific area reflecting the country's commitment to create a fully integrated and functional market, enabling the free flow of energy through the EnC and the EU with adequate infrastructure and free of technical or regulatory barriers.
- **Research, Innovation and Competitiveness:** a specific area linked to the country's commitment towards supporting breakthroughs in low-carbon and clean energy technologies.

1.3 DESCRIPTION AND EVALUATION OF ALTERNATIVES

Until now, it has been a common practice in Serbia that when considering alternative solutions, the alternative solution of not implementing strategies, programs and plans (business as usual), and the favourable scenario from the aspect of environmental protection with additional measures (WAM), as is presented in the INECP, are considered in the SEA.

- **Scenario with existing measures (WEM)**

The existing structure of the energy sector of the Republic of Serbia requires significant changes, arrangements and investments, in order to be harmonized with the European policy in this area. In this sense, the Republic of Serbia plans to set ambitious sustainable goals for reducing GHG emissions, increasing the share of RES, and with regards to the levels of primary and final energy consumption.

The WEM scenario favours a situation which does not meet the fulfilment of the energy and climate change targets (European Green Deal) and does not promote sustainable development. It only includes policies and measures in force until 2020, without any additional interventions.

More particularly it does not favour:
a) **decarbonisation**, where decarbonisation of the economy entails stopping the use of fossil fuels, with an accompanying increased participation of renewable energy sources;
b) **energy security** where security of supply should be based on diversification of sources and on the ability to deliver energy to consumers from different sources, different technologies, different import arrangements, etc. in such a way that the system does not at any moment depend on any homogeneous source or technology, etc. Today most of the existing facilities are about 40 years old, have approximately the same technology and depend more or less on one and the same source, which is lignite;
c) **energy efficiency**, where today Serbia consumes 50 % more energy than EU countries. Focusing on energy efficiency, especially for households and the economy, seems imperative (research has shown that 85 % of residential buildings in Serbia do not meet the minimum energy efficiency requirements);
d) **integration of the internal energy market** where internal markets need to be established in individual countries, then these markets can be integrated into a common one market;
e) **research and innovation** need to be further promoted and continue to be a priority through supporting innovative technologies, which will contribute to the fulfilment of the energy and climate targets.

The “With Existing Measures” (WEM) scenario corresponds to the projection having only the policies in place until 2020, without any additional effort. Therefore:

a) There is no carbon pricing applied in WEM. Electricity generation from lignite fired power plants increases in 2030 by 23% compared to 2019 and continues to be at almost the same level until 2050.

b) The penetration of renewable energy sources is limited, and nuclear power is not considered as an option.

c) Energy efficiency is limited to the rate observed until 2020.

d) There is no introduction of hydrogen in the final energy consumption, and limited introduction of biofuels in transport.

e) Primary energy consumption in 2030 reaches 17,528ktoe and the final energy consumption reaches 10,909 ktoe.

f) The penetration of EVs is limited without any extra measure for their promotion.

- **Scenario With Additional Measures (WAM) – Proposed INECP**

INECP 2030 has as its compass the "sustainable development of Serbian energy sector in a way that is beneficial to the economy, society and the environment" for the next decade. It defines strategic priorities for the energy sector development in the Republic of Serbia which are established within the Plan. Particularly, the main pillars of the INECP comprise an increased penetration of RES in Serbia's energy mix along with targeted energy efficiency measures aiming to reduce the final energy consumption by increasing energy performance. This clean energy transition pathway tends to enhance the country's energy security, safeguards its energy dependency while ensuring a realistic reduction of lignite use, contributing to a meaningful reduction of the GHG emissions by 2030. The proposed measures, activities and projects are aimed at overall transition to sustainable energy sector in Serbia. The proposed categories of interventions in the INECP are expected to act positively in terms of sustainable development as they incorporate the dimension of a development approach that is expected to be implemented with due care for the protection of the environment and the preservation of resources, so that the sustainability and development of future generations is not jeopardized, including economic, social and environmental aspects which are mutually reinforcing.

INECP constitutes an integrated and continual planning approach by seeking sustainable measures through integrating realistic objectives with potentials in the energy sector on the one hand, and the need for protecting the environment, quality of life of people and socio-economic development, on the other.

The scenario S (WAM) with additional measures has two options:

- Scenario S without nuclear energy;
- SN scenario with nuclear energy.

The specifics include:

- A moderate process of decarbonisation until 2030, i.e., a reduction in electricity production from lignite fired thermal power plants until 2030 (25 % compared to 2019). However, it is expected some necessary modernization of mining sector in order to safeguard the operation of the existing lignite power plants.
- By 2050, lignite fired thermal power plants will completely stop producing electricity in both variants of this scenario, it is foreseen that, in the entire period, part of the coal-fired thermal power plants that will not be in operation can be used as a reserve, with

a capacity of 1,427 MW in the year 2050, in the variant without nuclear energy and 745 MW in the variant with nuclear energy.

- In the scenario with nuclear energy, nuclear power plants are introduced into the power system after 2040 with a capacity of 1000MW.
- In both scenarios, the total consumption of primary energy is 14,689 ktoe, and the consumption of final energy is 9,670 ktoe in 2030. This is very important from the aspect of energy efficiency because the implementation of energy efficiency measures is evaluated according to the consumption of primary and final energy, which must not exceed the values obtained in these scenarios.

Input data related to the building renovation rate, the participation of heat pumps and solar water heaters, the share of biofuels in traffic and electric vehicles as well as RES in district heating are the same in both S scenarios.

The Table below presents a comparison of the expected results of WEM and WAM scenarios.

THE RESULT	Base year 2020	WEM Projection for 2030	Scenario-S Projection for 2030
GHG Emissions in ktCO$_2$ eq (to be compared to 1,990 when 80,094 ktCO$_2$ eq)	56,163	64,577	47,765
Reduction of GHG emissions in % compared to 1990	29.9%	19.3%	40.3%
Share of renewable energy sources in gross final energy consumption in %	26.3%	27.6%	33.6%
Share of RES in electricity production, %	29%	29%	45%
- consumption of primary energy Mtoe	15,083	17,600	14,689
- consumption of final energy Mtoe	8,887	10,615	9,670
Import dependence, total energy, %	32%	35%	41%
Import dependence, electricity, %	-0.5%	-4.4%	-1.6%
Electricity production in GWh	37,615	45,892	40,185
Installed capacities for electricity production in MW, of which:	8,660	9,777	11,216
- RES capacities (including hydro) in MW	2,893	3,698	6,217
- Reversible HE(additional 680 MW will be in operation in 2031)	614	614	614
- CCGT Power Plant in MW	/	/	350
Overall Planned Public Aid Investment needs until 2030 in INECP	/	5.69 billions €	10.04 billion€
Change of unemployment with respect to WEM in 2030 (%)	/	/	+0.2%
Change in GDP with respect to WEM in 2030 (%)	/	/	+1.5%

From this Table, by seeing some key figures, it becomes obvious the scenario WAM offers the most environmental and socio-economic advantages (GHG Emissions in ktCO2 eq which is 47,765, Reduction of GHG emissions in % compared to 1990 which is 40.3%, and reduction of GHG emissions without sink is 33.3% compared to 1990, the Change of unemployment with respect to WEM in 2030 (%) which is +0.2%, the Change in GDP with respect to WEM in 2030 (%) which is +1.5%.

Concluding, the implementation of WAM scenario is expected to contribute to high rates of economic growth, the creation of new jobs and most importantly a balance between the development of the energy sector and environmental protection, as a key requirement of the Green Agenda, whereas by having WEM the problems currently facing the energy sector are expected to be perpetuated.

From the comparison of the two Alternative Scenarios carried out in the framework of this SEA, the WEM Scenario is clearly less favourable from an environmental and socio-economic point of view compared to the WAM scenario. We therefore conclude the preferred option is WAM.

1.4 OVERVIEW OF ENVIRONMENTAL ASSESSMENT & KEY CONCLUSIONS

Overall, the majority of impacts of the proposed INECP are assessed as positive.

The most **significant positive impacts** are identified at the level of the SEA areas:

- Climate Change
- Socio-economic impacts

Indicatively, positive impacts include:

- environmental quality: reduced GHG emissions due to increased use of renewable energy sources (RES) and application of clean technologies in thermal power plants in accordance with the Law on IPPC (integrated pollution prevention and control), further development of national legislation in accordance with international obligations and EU regulations;
- The implementation of a wide set of energy efficiency measures will contribute to more rational energy consumption, the development of legal norms in accordance with international obligations and EU regulations, and their application through an improved institutional framework will create preconditions for reducing pollution;
- Improving the quality of the environment thanks to afforestation, the use of new technologies in agriculture and a significant improvement of waste management

particularly through increased recycling and composting as a share of total treated waste in the territory of Serbia;

- Socio-economic development: energy development which supports economic growth, definition of energy and fuel prices on market principles, development of local industry and applied scientific research for the transfer of the most modern technologies in the field of energy, strict implementation of energy efficiency measures in final energy consumption, mobility of the labour force on the market, as well as the overall development of the energy sector, will in the long term significantly contribute to the overall sustainable economic development of society and the rational use of non-renewable energy sources, as well as to an increase in the share of the use of greener energy sources. Also, scenario S in the sectors of forestry, agriculture and waste management (by promoting circular economy) will contribute to a significant improvement in the quality of life and wellbeing of the population and the creation of new jobs in these economic sectors.

Principal **negative impacts** include impacts linked to the construction stages of infrastructure as well the potential impact below:

- Impacts linked to RES (modern solar power plants and wind farms), where one can expect change of land uses for large areas of land, significant amounts of E-waste after the use of solar panels, electric shock, lightning strike, fire, etc. Construction of large solar power plants involves occupying a considerable area of land. If infrastructure is placed on natural habitats, loss, fragmentation and degradation of ecosystems can occur, which can have a negative impact on flora and fauna that are associated with those habitats. Large solar power plants can represent barriers to animal movement, especially if they are positioned in places that represent parts of migration corridors, which can hinder access to food, water and adequate habitats, as well as the passage of mating partners. In this way, a decrease in numbers and genetic isolation of populations can occur in the absence of preventive or mitigation measures. Solar power plants can also affect the microclimatic conditions in the immediate surroundings. Installing solar panels can also create shade and change the temperature and water regime of the habitat. These changes can have consequences for flora and fauna, especially if they are not considered at the stages of planning and construction.
- Regarding wind power plants, potential negative impacts on the protected ornitofauna and chiropterofauna are possible. In addition, since wind turbine propellers are made of composite materials, it is necessary to consider the problem of propellers at the end of their life.
- In the electrification of transportation, larger amounts of used batteries are expected.
- Certain negative implications could also be expected due to the construction of large HPPs, the construction of which could have a negative impact on the hydrological regime of the watercourses where construction is planned, biodiversity and ichthyofauna, and a possible change in the use of agricultural and forest land.

- Potential impacts linked to the construction of a large number of small hydropower plants on one watercourse. For such interventions, guidelines for lower hierarchical levels of planning are set forward which propose the preparation of certain planning documents and project impact assessments, so that for each specific location for which a change of use is expected, the positive and negative impacts of these interventions on the environment are evaluated.
- Potential impacts linked to the construction of a considerable number of infrastructure projects (interconnection projects, gas pipelines and interconnections, etc) which are expected to be of regional/local character, temporary and reversible with proper environmental management., short-term and

The implementation of the relevant legal and regulatory framework in place, responsible planning and implementation of actions in line with international best practices and applying preventive and mitigation measures as outlined in the SEA and/or future Environmental Impact Assessments (EIAs) are expected to significantly reduce any negative impacts.

The impacts on the environmental objectives are presented in the summary matrix below.

- **Negative** Impact	■
0 **Neutral** Impact	0
? Unknown	?
+/- **Mixed** Impact	■
+ **Positive** Impact	■

Table 1.1: Specific environmental objectives of SEA

No.	Specific objectives of the SEA	No.	Specific objectives of the SEA
SEO 01.1	Increased share of RES energy in BFPE at least 35.9 % in 2030	SEO 04.2	Sustainable use of water
SEO 01.2	Increasing energy efficiency and reduction of final consumption	SEO 04.3	Protection and sustainable use of agricultural and forest land
SEO 01.3	Reduction of energy consumption in transport	SEO 05.1	Preservation of biodiversity
SEO 01.4	Promotion of circular economy	SEO 05.2	Preservation of areas with nature protection status
SEO 02.1	Reduction of air emission, including GHG emissions, by 40.3% in 2030 compared to 1990	SEO 06.1	Preservation of the state of cultural heritage sites and archaeological remains
SEO 02.2	Ensured supply of adequate and healthy drinking water to the population	SEO 07.1	Preservation of exceptional landscapes, areas of national recognition and recognizable and typological characteristics of the landscape
SEO 02.3	Reduction of noise and vibrations pollution	SEO 08A.1	Ensure economic and social stability
SEO 02.4	Reduction of electromagnetic radiation	SEO 08B.1	Increase of investments in energy infrastructure and environmental protection
SEO 02.5	Reduction of generated waste and improved treatment and disposal of waste	SEO 08B.2	Improvement of institutions and personnel for environmental protection and climate change monitoring
SEO 03.1	Prevention of natural and anthropogenic-technological disasters.	SEO 08B.3	Improvement of research, innovation and competitive employment
SEO 04.1	Improved status or ecological potential of bodies of water, including surface water and groundwater		

Table 1.2: Summary of evaluation

Area of SEA	No. of specific objective	Thematic area of INECP: Decarbonisation – Reduction of GHG emission	Decarbonisation – RES	Energy efficiency	Energy security	Internal energy market	Research, innovation and competitivenes s	Overall by SEA areas
1. Climate Change	SEO 01.1	🟩🟩	🟩🟩	🟩🟩	0	🟩	🟩	🟩🟩🟩🟩🟩🟩🟩🟩
	SEO 01.2	🟩	🟩🟩	🟩🟩	0	🟩	🟩	🟩🟩🟩🟩🟩🟩🟩
	SEO 01.3	🟩	🟥	🟩	0	?	🟩	🟥🟩🟩🟩?
	SEO 01.4	🟩	🟩	🟩	0	0	🟩	🟩🟩🟩🟩
2. Human Health and Quality of Life	SEO 02.1	🟩🟩	🟩🟩	🟨	🟥	🟥	🟩	🟥🟥🟨🟨🟩🟩🟩🟩
	SEO 02.2	🟩	🟥	🟥	🟥	🟥	🟩	🟥🟥🟥🟥🟩🟩
	SEO 02.3	0	🟨	🟨	🟥	🟥	🟩	🟥🟥🟨🟨🟩
	SEO 02.4	0	🟥	0	🟥	🟥	0	🟥🟥🟥
	SEO 02.5	🟩🟩	🟨	🟨	🟥	🟥	🟩	🟥🟥🟨🟨🟩🟩🟩
3. Natural and other disasters	SEO 03.1	🟩	🟥	🟨	🟨	🟥	?	🟥🟥🟨🟨🟩?
4. Sustainable management of natural resources	SEO 04.1	🟩	🟨	🟥	🟥	🟥	🟩	🟥🟥🟥🟨🟩🟩
	SEO 04.2	🟩	🟨	🟥	🟥	🟥	🟩	🟥🟥🟥🟨🟩🟩
	SEO 04.3	🟩	🟨	🟨	🟨	🟨	🟩	🟨🟨🟨🟨🟩🟩
5. Nature	SEO 05.1	🟩	🟥	🟨	🟥	🟥	🟩	🟥🟥🟥🟨🟩🟩
	SEO 05.2	🟩	🟨	🟨	🟨	🟨	🟩	🟨🟨🟨🟨🟩
6. Cultural heritage	SEO 06.1	0	🟨	🟨	🟨	🟨	0	🟨🟨🟨🟨
7. Landscape	SEO 07.1	0	🟥	🟥	🟥	🟥	0	🟥🟥🟥🟥
8. Socio-economic aspects	SEO 08A.1	🟩🟩	🟩🟩	🟩🟩	🟩🟩	🟩🟩	🟩	🟩🟩🟩🟩🟩🟩🟩🟩🟩🟩🟩
	SEO 08B.1	🟩🟩	🟩🟩	🟩🟩	🟩🟩	🟩	🟩🟩	🟩🟩🟩🟩🟩🟩🟩🟩🟩🟩🟩
	SEO 08B.2	🟩🟩	🟩🟩	🟩🟩	🟩	🟩	🟩🟩	🟩🟩🟩🟩🟩🟩🟩🟩🟩🟩
	SEO 08B.3	🟩	🟩	🟩	🟩	🟩	🟩🟩	🟩🟩🟩🟩🟩🟩🟩

1.5 INDICATIVE MITIGATION AND MONITORING MEASURES

Based on the results of the multi-criteria evaluation of the planned policies and measures according to the basic WEM and WAM scenarios, it is necessary to apply general measures for the implementation of these measures, future negative factors. environmental impacts and elements of sustainable development were identified:

- The application of environmental legislation is an obligation, as well as the implementation of international obligations in the field decarbonisation;
- Mandatory implementation of measures to achieve environmental objectives in accordance with the regulations of the Law on Water ("Official Gazette of the RS", no. 30/10 and 93/12), and other accompanying regulations which includes prevention of deterioration, environmental protection and environmental protection for all water bodies, in order to achieve a good status of surface and ground waters and protected areas;
- Give priority to create register of polluting substances for the energy and industry sectors with GHG emission balances;
- Ensure education and participation of the public in all phases of realization of energy projects; ensure the participation of local communities, on whose territories emission reduction measures are foreseen, in decision-making in all stages of the implementation of these measures;
- In relation to activities that are determined to have a significant adverse transboundary impact, the "Party" or the State shall undertake activities to ensure adequate and effective intervention by any other state activity (state) related to the other party (country). as soon as possible, and at the latest when he informs the public about that activity.
- Obligatory implementation of environmental quality monitoring in accordance with relevant legislation and the Environmental Monitoring Program defined in this SEA;
- Mandatory application of the environmental impact assessment guidelines defined in this SEA and to elaborate them in detail in the process of implementing specific technical solutions, i.e. when preparing an EIA of the project regarding fossil fuels, renewable energy sources, district heating, electricity transmission and distribution infrastructure, natural gas, coal infrastructure, energy efficiency measures in housing, construction, industry, traffic, as well as energy measures in the electricity generation

sector and incentive measures related to renewable sources energy;

- Usage of biomass should be priority for food production in order to avoid competitiveness in energy production.

The basic guidelines / measures proposed for the prevention, reduction and offset of the effects on the various environmental parameters of the implementation of the INECP are described in detail in Section 5.2 of the report.

2 INTRODUCTION

2.1 PURPOSE OF THE STUDY

Strategic Environmental Assessment (SEA) is the formal, systematic evaluation of the likely significant environmental effects of implementing a plan or programme, or variation to a plan or programme before a decision is made to adopt it.

Regarding the development of the Integrated National Energy and Climate Plan of the Republic of Serbia for the period up to 2030 with a vision up to 2050 (hereinafter INECP), the strategic environmental impact assessment is a procedure that provides conditions for appropriate environmental protection during the development of the Plan, i.e., integrating protection of the environment into phases and solutions of INECP development.

The report on the strategic impact assessment of the INECP is a document that describes, evaluates and assesses possible significant impacts on the environment that may occur through the implementation of the plan, and which determines measures to reduce negative impacts on the environment.

The Report also provides a comparative analysis of alternative scenarios that were considered during the preparation of the INECP; the scenario with existing measures (WEM) and the scenario with additional measures (WAM).

Based on Article 5, paragraph 1 and Article 9, paragraph 1. and 5 of the Law on Strategic Environmental Impact Assessment ("Official Gazette of the RS", no. 135/04 and 88/10), the Ministry of Mining and Energy issued a Decision on the preparation of the Strategic Environmental Impact Assessment of the Integrated National Energy and Climate Plan of the Republic of Serbia (No. 011-00-176/2021-11 dated August 3, 2021). The decision was published on the website of the Ministry of Mining and Energy.

The report according to Article 12 of the Law on Strategic Impact Assessment contains the following chapters:

1) Background information for the Strategic Environmental Assessment; (Chapter 3)
2) General and specific objectives of Strategic Environmental Assessment and selection of indicators; (Chapter 4)
3) Assessment of the potential environmental impacts and measures to reduce negative impacts on the environment; (Chapter 5)

4) Guidelines for making strategic assessments at lower hierarchical levels and assessing the impact of projects on the environment; (Chapter 6)

5) Environmental monitoring program during the implementation of the Strategy; (Chapter 7)

6) Overview of the methodology and difficulties encountered; (Chapter 8)

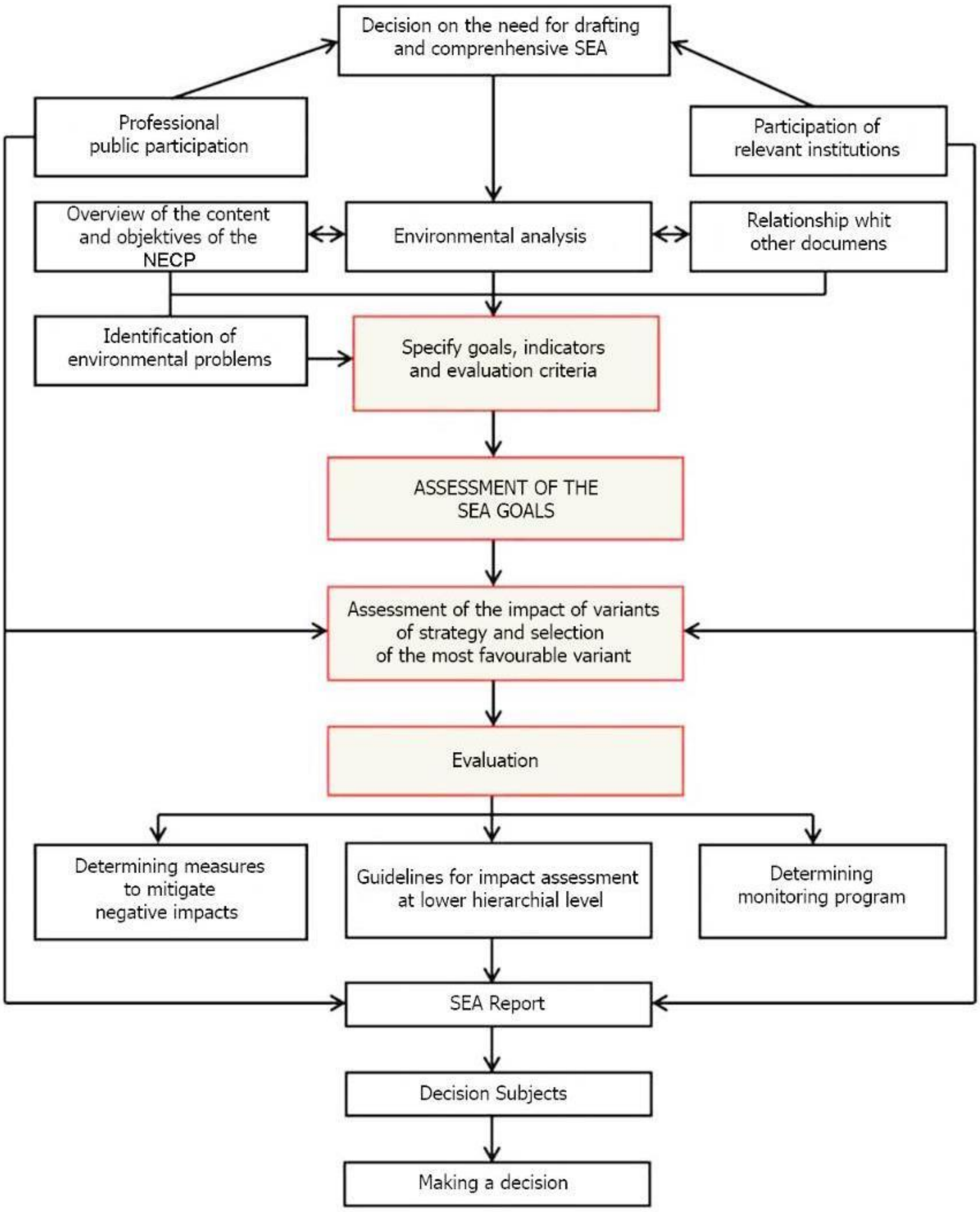
7) Decision-making methods; (Chapter 9)

8) Overview of conclusions reached; (Chapter 10)

Additional data of importance for the Strategic Environmental Assessment is presented throughout the report.

In Figure 2.1 the procedural and methodological framework for conducting the SEA is presented

Figure 2.1: Procedural and methodological framework



2.2 LEGAL AND REGULATORY FRAMEWORK

For the purpose of the study, the international or community or national environmental protection objectives that should be taken into account will be investigated in this chapter, in order to determine the basic environmental objectives for the Plan. The relationship of the Plan with other related plans and programs is also being investigated.

The Government of the Republic of Serbia adopted on October 9, 2008, the National Program for the Integration of the Republic of Serbia in the EU (NPI), which was the first comprehensive document on the basis of which all legislative, institutional and administrative measures in the process of European integration were planned from 2008 to 2012.

After obtaining the status of a candidate for EU membership, the Government of the Republic of Serbia on February 28, 2013 adopted the National Program for the Adoption of the Acquis (NPAA).

The first revision of the NPAA was adopted in 2014, the second revision of this program was adopted on November 17. 2016, in the phase of receiving screening reports, developing action plans for meeting the criteria for opening negotiations in individual chapters, as well as preparing negotiating positions. The third revision of the NPAA was adopted on March 1, 2018, in the circumstances of intensive preparation of documents from the negotiation process, opening and temporary closing of a certain number of negotiation chapters. The deadline for harmonizing the domestic legal framework with the EU legal framework is set for the end of 2021.

Deadlines for the application of certain EU regulations in the field of environmental and climate protection will be defined during the negotiation process.

2.2.1 STRATEGIC ENVIRONMENTAL ASSESSMENT (SESA) FRAMEWORK

- **Directive 2001/42/EC of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment (SEA Directive)**

The Directive 2001/42/EC on the assessment of certain plans and programs on the environment applies to a wide range of public plans and programs. Based on Art. 13.1 of the Directive, Member States committed to bring into force the laws, regulations and administrative provisions necessary to comply with this Directive before 21 July 2004.

Plans and programmes in the sense of the SEA Directive must be prepared or adopted by an authority (at national, regional or local level) and be required by legislative, regulatory or administrative provisions.

As mentioned above, the SEA Directive 2001/42/EC requires, inter alia, that SEA is undertaken for certain plans and programmes which are prepared for a number of sectors, including **energy**.

The main objective of the SEA Directive is to provide for a high level of protection for the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view to promoting sustainable development. The SEA procedure can be summarized as follows: an environmental report is prepared in which the likely significant effects on the environment and the reasonable alternatives of the proposed plan or programme are identified. The public and the environmental authorities are informed and consulted on the draft plan or programme and the environmental report prepared. The environmental report and the results of the consultations are taken into account before adoption. Once the plan or programme is adopted the environmental authorities and the public are informed, and relevant information is made available to them. In order to identify unforeseen adverse effects at an early stage, significant environmental effects of the plan or programme are to be monitored[1].

- **Law on Strategic Environmental Impact Assessment ("Official Gazette RS", no. 135/04 and 88/10)**

The strategic assessment of the impact of the Integrated National Energy and Climate Plan of the Republic of Serbia (INECP) for the period up to 2030 with a vision up to 2050 (hereinafter: strategic assessment) was made in accordance with the Law on Strategic Environmental Impact Assessment ("Official Gazette RS", no. 135/04 and 88/10) and the Law on Environmental Protection ("Official Gazette of the RS", No. 135/04, 36/09, 36/09-other law, 72/09-other law , 43/2011-US decision, 14/16, 76/18, 95/18-other law and 95/18-other law).

The Law on Strategic Environmental Impact Assessment regulates the conditions, method and procedure for assessing the impact of certain plans and programs on the environment in order to ensure environmental protection and promotion of sustainable development by integrating the basic principles of sustainable development into the procedure of preparation and adoption of plans and programs.

The Law on Strategic Environmental Impact Assessment to a large extent, reflects the transposed EU Directive on the impact of certain plans and programs on the environment, whereby it was sought to prescribe general requirements and basic stages of the strategic environmental impact assessment process and ensure a quality procedure that is applied in across the EU. As a tool for the competent authorities in deciding on the preparation of a strategic assessment and assessing the quality of the strategic assessment report in the process of giving consent to the strategic assessment report Regulation on public participation in the development of certain plans and programs in the field of environmental protection and several other regulations w adopted.

In accordance with Article 13 of the Law on Strategic Environmental Impact Assessment, basic information for strategic assessment includes:

- A brief presentation of the content and objectives of the plans and programs and the relationship with other plans and programs;

[1] https://ec.europa.eu/environment/eia/sea-legalcontext.htm

- Presentation of the current state and quality of the environment in the area to which the report refers;
- Environmental characteristics of areas likely to be significantly impacted;
- Issues and problems of environmental protection that were considered in the plans and programs and stating the reasons for omitting certain issues and problems from the assessment procedure;
- Presentation of prepared alternative solutions related to environmental protection in plans and programs, including the zero-alternative solution of plans and programs and the most favourable solution from the aspect of environmental protection;
- The results of previous consultations with competent authorities and organizations that are relevant in terms of the objectives and assessment of the potential impact of the strategic assessment.

2.2.2 INTERNATIONAL, EU & NATIONAL TARGETS

► **8th Environment Action Program (EAP)**

On 2 May 2022 the 8th Environment Action Programme entered into force. The 8th EAP serves as a guide for the design and implementation of environmental and climate policy until 2030. It sets out priority objectives for 2030 and the conditions needed to achieve these. Building on the European Green Deal, the action programme aims to speed up the transition to a climate-neutral, resource-efficient economy, recognising that human wellbeing and prosperity depend on healthy ecosystems. The six thematic priority objectives of the 8th EAP concern: GHG emissions reductions, adaptation to climate change, a regenerative growth model, a zero-pollution ambition, protecting and restoring biodiversity, and reducing key environmental and climate impacts related to production and consumption.

► **United Nations Agenda 2030 for Sustainable development (UN Agenda 2030)**

The Agenda 2030 for Sustainable Development, the 17 Sustainable Development Goals and the 169 sub-goals were adopted by the 70th United Nations General Assembly on 25 September 2015 with the Resolution "Transforming our world: The 2030 Agenda for Sustainable Development". The Agenda 2030 is the most ambitious global agreement the UN has ever achieved, as it is an action plan for People, Planet and Prosperity. The 2030 Agenda promotes the integration of all three dimensions of sustainable development –social, environmental and economic – in all sectoral policies, while promoting the interconnection and coherence of the Sustainable Development Goals (SDGs)-related policy and legislative frameworks.

The 17 SDGs were adopted by the 193 UN member states, are universal, with an implementation schedule until 2030. They are the road map to achieving a better and sustainable future for all, they are interconnected and indivisible so that the achievement of one Goal has an impact on others.

Figure 2.2: Sustainable Development Goals of Agenda 2030

The Agenda 2030 is an integrated plan of action structured in four main parts: (I) a Vision and Principles for Transforming our World as set out in the Declaration; (II) Results framework of global Sustainable Development Goals – SDGs; (III) Means of Implementation and Global Partnership; and (IV) Follow-up and Review.

National Strategy for Agenda 2030

The Republic of Serbia is firmly committed to promoting an accelerated implementation of the 2030 Agenda in the common quest to profoundly transform our world. In the national consultations on the new global development agenda, launched in 2012, its citizens have already voiced unequivocally that *Serbia We Want* respects and cherishes differences and that it is a peaceful and democratic, socially just and gender-equal, intra- and inter-generationally equitable country in which every individual exercises its right to well-being and prosperity and enjoys the protection of personal dignity and freedom of choice. Within the scope of the *National Sustainable Development Strategy* (2009-2017) ("Official Gazette of RS", No. 57/08) and pursuant to the EU accession negotiation process started in 2014.

Serbia participated actively in the work of the OWG on Sustainable Development Goals (SDGs) and the Intergovernmental Committee of Experts on Sustainable Development Financing.

The attainment of lasting prosperity for everyone everywhere within planetary boundaries by growing into sustainability is a ***clear, strategic, long-term national vision*** of the implementation of the 2030 Agenda in Serbia. In 2015, an ***integrated, networking institutional mechanism*** was established to build innovative practices in balancing all dimensions of sustainable development.

The Inter-Ministerial Working Group for the Implementation of the 2030 Agenda (IMWG) coordinates the work of all Ministries and State institutions. The partnering endeavour of the Secretariat for Public Policy in mapping the National Strategic Framework against the SDGs resulted in the *Serbia and the 2030 Agenda* document. The Statistical Office of the Republic of Serbia diligently maps, produces or collects ***relevant national indicators*** to credibly measure progress on the SDGs.

The Focus Group of the National Assembly of Serbia for the Development of Control Mechanisms for the Process of Implementation of the SDGs, formed in 2017, initiated the first public hearing on SDGs implementation. The Assembly creates a legal framework and ensures budgeting for the SDGs. Through liaising with local, cross-border, regional and international stakeholders and through inter-parliamentary cooperation, it is becoming the centre stage for public advocacy of the SDGs.

Deep structural reforms in Serbia, including provision of sustainable public finances, the 2030 Agenda financing included, enable the highest-aiming SDGs achievement. In collaboration with the UN development system, the Government identified ***the inter-linkages between the goals and targets with the acquis communautaire*** through RIA. The MAPS mission to Serbia in 2018 provided ***support to improving coherence of sectoral and inter-sectoral government policies for the SDGs***. The same year, the IMWG supported by the UN Country Team, organized the *Subregional Conference on the Promotion and Progress on the 2030 Agenda* providing momentum to the achievement of the SDGs throughout the region.

A bold, long-term vision of transforming into sustainability within the Serbian strategic framework is laid on the two pillars: the *National Programme for Adoption of the Acquis 2018-2021* and the *National Priorities for International Assistance 2014-2017*, with projections until 2020.

Cohesive with the EU sustainability transformation, the Serbian Government established ***six strategic pathways for the growing into sustainability for everyone everywhere***:

- Connect, partner and integrate Serbia in Europe and the world;

- Achieve a faster, inclusive and sustainable growth, based on economic, scientific and innovation resources;
- Render efficient and effective public services;
- Promote human rights and security;
- Education for the twenty-first century;
- Transformative digitalization.

Through the broad coordinated network of partners, the mainstreaming of the 2030 Agenda implementation in Serbia evolves through monitoring, reviewing, reporting and following up by the State institutions, local authorities and communities, human rights mechanisms, civil society, social partners, business communities, academia and research community, bilateral and multilateral development partners within, across, and beyond borders.

- **European Green Deal**

The European Green Deal is a package of policy initiatives, which aims to set the EU on the path to a green transition, with the ultimate goal of reaching climate neutrality by 2050. It supports the transformation of the EU into a fair and prosperous society with a modern and competitive economy. It underlines the need for a holistic and cross-sectoral approach in which all relevant policy areas contribute to the ultimate climate-related goal. The package includes initiatives covering the climate, the environment, energy, transport, industry, agriculture and sustainable finance – all of which are strongly interlinked. It also aims to protect, preserve and strengthen the EU 's natural capital, as well as to protect the health and wellbeing of its citizens from risks and effects related to the environment. At the same time, this transition must be fair and inclusive. It must give priority to the people and take care of the regions, the sectors and the workers who will face the greatest challenges. As it will bring about substantial change, active public participation and confidence in the transition are paramount to the effectiveness and acceptance of policies.

In order the achieve the above, action will be taken in all sectors of the economy, such as:

- investments in environmentally friendly technologies
- supporting innovation in the industrial sector
- development of cleaner, more economical and healthier forms of private and public transport
- freeing the energy sector from carbon emissions
- ensuring the energy efficiency of buildings
- collaboration with international partners to improve global environmental standards.

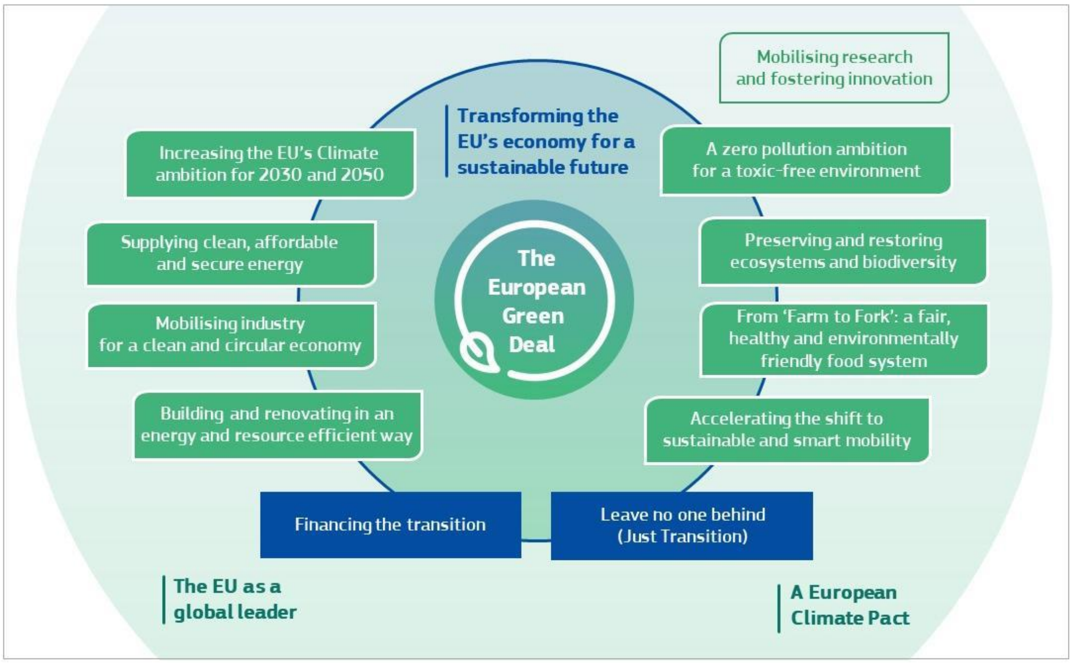


Figure 2.3: Elements of European Green Deal

► Green Agenda for the Western Balkans

The Green Agenda for the Western Balkans is the growth strategy for the region that aims to tackle the challenges of climate change and green transition and assist the Western Balkan (WB) countries to align environmental regulations with the European acquis. The Green Agenda for the WB is based on the European Green Deal and the related Economic and Investment Plan for the WB.

With the financial support of the European Union and in partnership with the Ministry of the Environment, the project "EU for Green Agenda in Serbia" is implemented by UNDP in cooperation with the Embassy of Sweden, the European Investment Bank and the Government of Switzerland.

In November 2020, the Republic of Serbia signed the **Sofia Declaration on the Green Agenda for the Western Balkans** at the Western Balkans Summit as part of the Berlin Process initiative and committed to work towards the 2050 objective of a carbon-neutral continent together with the European Union. The country also recognized the European Green Deal as a new growth strategy towards a modern, climate-neutral, resource-efficient and competitive economy of the European Union.

An important area of the Green Agenda is that the transition to climate-neutrality must be socially just and inclusive in order to be a success. Therefore, the project activities are designed to ensure that the costs and benefits of the green transformation and decarbonization are evenly distributed across society.

The project will use the "Innovation Challenge" approach to engage different parts of society. This is a proven methodology to source innovative and cost-efficient ideas, technologies, and business models that will lead to improving social, economic and environmental conditions for all citizens in Serbia as foreseen by the Green Agenda.

Its goal is to contribute to the efficient, inclusive and sustainable implementation of the Green Agenda in Serbia by:

- improving the strategic and legislative framework,
- co-financing implementation of innovative pilot projects and
- mobilizing additional financing for scale-up investments.

In this way, the project will contribute to the green transformation of economy and society in Serbia.

The project's focus is to contribute to the decarbonisation of the economy and achievement of the Paris Agreement goals, reducing environmental pollution (air, soil and water) and supporting the alignment of Serbia's regulatory framework with the EU acquis in following 5 pillars of the Green Agenda:

- Climate action, decarbonization, energy efficiency and green industries,
- Circular economy for resource efficiency and industrial symbiosis,
- Depollution of the environment with strong focus on air quality,
- Protecting and investing in biodiversity and ecosystems,
- Sustainable food systems for sustainable rural livelihood.

► UN Framework Convention on Climate Change

Climate action in the EU is drawn up in line with the objectives of the United Nations Framework Convention on Climate Change (UNFCCC, 1992), and the Kyoto Protocol (1997), which is the first legally binding agreement on emission reductions resulting from the convention. The Convention was ratified by the European Community with decision 94/69/EC (EC, 1994).

For the first period of commitment to the protocol (2008-2012), the EU countries set the goal of a joint emission reduction of 8% compared to 1990.

The ultimate objective of the UNFCCC is to stabilize GHG concentrations "at a level that would prevent dangerous anthropogenic (human induced) interference with the climate system". It states that "such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner".

The Convention was adopted and signed at the World Summit in Rio de Janeiro, Brazil, in June 1992, and entered into force in March 1994. The Republic of Serbia has been a member **of the UN Framework Convention on Climate Change** since June 10, 2001. By 2022, the UNFCCC had 198 parties.

To boost the effectiveness of the 1992 UNFCCC, the Kyoto Protocol was adopted in December 1997. The Republic of Serbia ratified the Protocol in January 2008. The Kyoto Protocol, which ran from 2005 to 2020, was the first implementation of measures under the UNFCCC. The main objective of the Kyoto Protocol was to reduce global anthropogenic emissions of GHG[2] by at least 5 % compared to the reference year 1990. The Kyoto Protocol was ratified by 183 countries (it had to be ratified by at least 55 countries, which would represent a share of at least 55 % of polluters, so it could come into force). The Republic of Serbia has adopted the Law on Ratification of the Kyoto Protocol with the UN Framework Convention on Climate Change ("Official Gazette of RS" - International Treaties, No. 88/07, 38/09 and 2/19). From 2008 until today, significant efforts have been made to establish legislative and institutional frameworks that directly or indirectly affect the implementation of activities related to climate change.

The **Initial National Communication (INC)** of the Republic of Serbia, as well as the **Second National Communication (SNC)** and the **First Biennial Update Report (FBUR)**, represent important national reporting documents to the UNFCCC and a basis for future actions, research, and policies in the area of climate change, national capacity building and improvement of knowledge and sustainable development of the country. In order to fulfil the UNFCCC reporting requirements, Serbia submitted its **First National Communication (NC1)** in 2010, **First Biennial Update Report (BUR1)** in 2016 and **Second National Communication (NC2)** in 2017. The preparation of the Second Biennial Update Report (BUR2) and Third National Communication (NC3) are currently ongoing.

The Kyoto Protocol was superseded by the Paris Agreement, which entered into force in 2016**.** The **Paris Agreement**, which is a legally binding international treaty on climate change. It was adopted by 196 Parties at the UN Climate Change Conference (COP21) in Paris, France, on 12 December 2015**.** Its overarching goal is to hold “the increase in the global average temperature to well below 2°C above pre-industrial levels” and pursue efforts “to limit the temperature increase to 1.5°C above pre-industrial levels.” The Republic of Serbia ratified the Paris Agreement in 2017 by the Law on ratification of the Paris Agreement ("Official Gazette of RS" - International Treaties, No. 4/17).

[2] Annex A of the Protocol lists 6 greenhouse gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), fluorocarbons (HFC), perfluorocarbons (PFC) and sulphur hexafluoride (SF_6).

The Paris Agreement was adopted as the first universal legally binding international treaty on climate change, and it requests each country to outline and communicate their post-2020 climate actions, known as their Nationally determined contributions (NDCs). NDCs embody efforts by each country to reduce national emissions and adapt to the impacts of climate change. The **First National Determined Contribution** was submitted in 2015, while **Second National Determined Contribution (NDC)** was submitted in August 2022, presenting higher ambitions and defining the intended reduction of emissions for 33.3% by 2030 compared to 1990.

It is to be noted that work on improving the inventory of gases with a greenhouse effect and updating Serbia's nationally determined contributions according to the Paris Agreement is slowly progressing. Harmonization of legislation on monitoring, reporting and verification of GHG emissions in accordance with the Emissions Trading System (ETS) and the Effort Sharing Directive has not yet been carried out. The Republic of Serbia needs to significantly improve its administrative and technical capacities at all levels and to additionally increase investments in the direction of the green transition.

Monitoring the obligation to adopt the Integrated National Energy and Climate Plan in accordance with the amendments to the Law on Energy, as well as the response to the Recommendation of the Ministerial Council of the Energy Community on the preparation for the development of the Integrated National Energy Plan and climate plans of the contracting parties of the Energy Community and relevant guidelines on the policy of the Secretariat.

The Climate Change Communication Strategy (2017) of Serbia provides guidance and recommendations on how to communicate the two main components of the fight against climate change: mitigation, dealing with the causes of global warming and aiming to reduce GHG emissions, and adaptation, the component that deals with the impact of climate change, in particular, climate change on society, the economy and the environment and promoting activities that reduce the vulnerability of communities to extreme weather conditions. The purpose of the Strategy is to develop a more systematic and effective approach in communicating the topic of climate change in Serbia, and its ultimate objective is greater participation of citizens and interested parties in all processes of importance for climate change. It is expected that this objective will be achieved by 2025. The main objective of the Communication Strategy is to raise the awareness of the community and all relevant target publics about the dangers and threats that are inevitably generated by climate change, but also about the possibilities, if mitigation and adaptation measures are planned and implemented in a timely manner and in accordance with the principles of sustainable development.

- **Circular economy**

In 2015, the European Commission adopted its first action plan for the circular economy (COM (2015) 614 final). The 54 actions of the first EU action plan have been implemented. The EU's transition to a circular economy is now guided by the new circular economy action plan adopted by the European Commission in March 2020. The circular economy action plan is in line with the EU target for Climate Neutrality by 2050 under the Green Agreement and aims to accelerate the transformational change required under the European Green Agreement, while taking advantage of the circular economy actions implemented after 2015. The circular economy package consists of an EU action plan for the circular economy, which sets out a specific and ambitious action plan, with measures covering the whole cycle: from production and consumption to waste management and purchase of secondary raw materials. The action plan introduces legislative and non-legislative measures targeting areas where action at EU level brings real added value and has the following objectives:

- Sustainable products should be the norm in the EU.
- Empowerment of consumers and buyers in the public sector
- Circularity in production methods focusing on the sectors that use the most resources and where the potential for circularity is high, such as: electronics, batteries and vehicles, packaging, plastics, textiles, construction and buildings, food, water and nutrients.
- Less waste, more value:
  - Improving water policy to support waste prevention and circularity.
  - Improving circularity in a toxic environment
  - Creating a well-functioning secondary market for secondary raw materials
  - Tackling waste exports from the EU.
- Ensuring the functionality of circularity for citizens, regions and cities.
- Guiding efforts for the global circular economy.

National Strategy for Circular economy

Serbia is in the process of preparing a **Roadmap for Circular Economy** by UNDP. The Roadmap for Circular Economy in Serbia is a process aiming to gather, promote and connect the identified stakeholders whose knowledge, innovation and creativity can contribute to a faster transition to circular economy. The document is a guide to circular economy transition models that equally focus on profit, environmental protection and preservation of resources. Economic, social and environmental dimensions are given equal importance. The goal of the Roadmap is to encourage manufacturing with the use of circular business models, to motivate the industry to create new jobs, and to improve doing business by finding innovative and sustainable solutions for the market. The intention of the document is to inspire the society to consider systemic changes in mindset, culture and attitude toward resources, as well as to encourage the political decision-makers to commit to altering the public policies and discourse in the context of circular economy. The document is the initial document aiming to start the dialogue between decision-makers, industry representatives, academia and civil society. Its purpose is to delineate the steps and timeline for the future transition, with the use of digital tools.

The EU has adopted a set of documents that provide guidelines to member states on how to transition from linear to circular economy. The most recent documents are the Green Deal and the Circular Economy Action Plan. Given that the Republic of Serbia is in the accession process to the EU, Serbia will be harmonizing the Roadmap with the EU recommendations. Therefore, in the upcoming period, a range of activities will be undertaken to this purpose, including developing a Circular Economy Roadmap 2.0.

- **Strategy for atmospheric pollution**

The EU has been working for decades to improve air quality, by controlling emissions of harmful substances into the atmosphere, by improving the quality of fuels and by integrating environmental protection requirements in the transport, industry and energy sectors. The aim is to reduce air pollution to levels that minimize harmful effects on human health and the environment throughout the EU.

The 2013 Clean Air for Europe program reaffirmed the objective of achieving full compliance with current air quality standards across the EU as soon as possible and set targets for 2020 and 2030. Therefore, policy efforts of the EU are based on three main pillars.

- The first pillar includes the ambient air quality standards set out in the ambient air quality guidelines for tropospheric ozone, particulate matter, nitrogen oxides, hazardous heavy metals and certain other pollutants. If the limit values are exceeded, Member States are required to adopt air quality plans in which they specify appropriate measures to keep the exceedance period as short as possible.
- The second pillar consists of national emission reduction targets set out in the National Emission Ceilings Directive for the most important transboundary air pollutants: sulphur oxides, nitrogen oxides, ammonia, volatile organic compounds and particulate matter .National emission reduction targets have recently been revised to include new limits to be met in 2020 and 2030, as well as an additional pollutant, fine particulate matter (PM2.5). Member States must draw up national air pollution control programs by 2019 in order to comply with their emission reduction commitments.
- The third pillar includes emission standards for the main sources of pollution, from vehicle and ship emissions to energy and industry. These standards are set at EU level in the legal acts concerning industrial emissions, emissions from power plants, vehicles and transport fuels, as well as the energy efficiency of products.

Fuel burning by power stations, industries and households to produce power and heat is the largest contributor to particulate matter and sulphur dioxide emissions. Measures to reduce air pollutant emissions from electricity and heat production are often accompanied by efforts to reduce GHG emissions. They include:

- increasing the use of non-combustion renewable energy sources (such as solar, wind or hydropower),
- cogeneration of heat and electricity,
- decentralized energy production (e.g., small-scale grids and solar energy production from installations on users' roofs),
- schemes, including tax incentives, to replace older and less efficient boilers in households;
- district heating and district cooling,
- in some cases, bans on burning solid fuels.

These measures are particularly effective in reducing particulate matter emissions. EU state aid rules create a framework that allows Member States to facilitate investment in such measures.

National Strategy for atmospheric pollution

Serbia adopted the Air protection program in the Republic of Serbia for the period 2022-2030 with an Action Plan ("Official Gazette of the RS"; number 140/22). Programme of Air Protection of the Republic of Serbia with Action Plan defines air quality goals and measures for their achievement. It said it also provides a basis for the adoption of bylaws and implementation of the European Union’s legislation in air protection.

To tackle air pollution, several local authorities have prepared or started preparing air protection plans.

- **Strategy for Biodiversity**

Convention on Biological Diversity

The Convention on Biological Diversity (CBD) is the international legal instrument for "the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources" that has been ratified by 196 nations. The Convention was opened for signature at the Earth Summit in Rio de Janeiro on 5 June 1992 and entered into force on 29 December 1993.

Its overall objective is to encourage actions, which will lead to a sustainable future.

The conservation of biodiversity is a common concern of humankind. The Convention on Biological Diversity covers biodiversity at all levels: ecosystems, species and genetic resources. It also covers biotechnology, including through the Cartagena Protocol on Biosafety.

In fact, it covers all possible domains that are directly or indirectly related to biodiversity and its role in development, ranging from science, politics and education to agriculture, business, culture and much more.

The Convention has three overarching objectives:

- The conservation of biological diversity (genetic diversity, species diversity and habitat diversity).
- The sustainable use of biological diversity.
- The fair and equitable sharing of the benefits arising out of the utilisation of genetic resources.

EU Biodiversity Strategy

The EU has a legal and institutional framework to protect biodiversity. Fundamentals are the guidelines for setting up the European Natura 2000 network of protected areas:

- Directive 92/43/EEC (L 158/13) from 10th of June 2013"on the conservation of natural habitats, as well as wild fauna and flora.
- Directive 2009/147/EC (L 158/13 and L170/19)) on the conservation of wild birds

The EU Biodiversity Strategy 2030 is a comprehensive, ambitious and long-term plan to protect nature and reverse ecosystem degradation. Contributions are regulated by the international negotiations on the post-2020 global biodiversity framework. It is a key part of the European Green Deal that will also support the green recovery after the COVID-19 pandemic. The EU's overall 2030 target is to put Europe's biodiversity on a recovery path by 2030, for the benefit of citizens, the climate and the planet. In order to put biodiversity on the path to recovery, the strategy sets out a series of targets and commitments to be met by 2030 at the latest, in the following four areas:

1. **A coherent network of protected areas which will**

- legally protect at least 30% of the EU's terrestrial and 30% of marine areas, and integrate ecological corridors, within a trans-European network for nature;
- strictly protect at least 30 % of the EU's protected areas, including all primary and old-growth forests;
- effectively manage all protected areas, by setting clear objectives and conservation measures and properly monitoring them;

In cooperation with EU countries, the European Commission will define and agree on criteria and guidance for the designation of additional protected and strictly protected areas by the end of 2021. EU countries will then have until the end of 2023 to demonstrate significant progress in determination of a new protected areas and integrating ecological corridors. The Commission will assess by 2024 whether the EU is on track to meet its 2030 targets or whether stronger actions, including EU legislation, are needed.

2. **EU nature restoration plan.** The plan contains the following specific targets:

- targets based on existing legislation (for wetlands, forests, grasslands, river and lakes, heath & scrub, rocky habitats and dunes) - improving and re-establishing biodiverse habitats on a large scale and bringing back species populations by improving and enlarging their habitats.
- pollinating insects – reversing the decline of pollinator populations by 2030, and achieving an increasing trend for pollinator populations, with a methodology for regular monitoring of pollinators.
- forest ecosystems – achieving an increasing trend for standing and lying deadwood, uneven aged forests, forest connectivity, abundance of common forest birds and stock of organic carbon.
- urban ecosystems – no net loss of green urban space by 2030, and an increase in the total area covered by green urban space by 2040 and 2050.
- agricultural ecosystems – increasing grassland butterflies and farmland birds, the stock of organic carbon in cropland mineral soils, and the share of agricultural land with high-diversity landscape features; restoring drained peatlands under agricultural use.
- marine ecosystems – restoring marine habitats such as seagrass beds or sediment bottoms that deliver significant benefits, including for climate change mitigation, and restoring the habitats of iconic marine species such as dolphins and porpoises, sharks and seabirds.
- river connectivity – identifying and removing barriers that prevent the connectivity of surface waters, so that at least 25 000 km of rivers are restored to a free-flowing state by 2030.

3. **Facilitating transformational change**

To ensure that commitments are delivered and to drive transformative change, the Commission and EU countries will take the following actions.

- They will set out the new EU governance framework for biodiversity, with implementation obligations and milestones, to ensure accountability and co-responsibility by all actors for meeting biodiversity commitments. The framework will also enhance stakeholder engagement and transparent and participatory governance. It will include a monitoring and review mechanism, with a clear set of agreed indicators, to enable regular assessment of progress and corrective action if necessary. The Commission will evaluate the approach in 2023 and consider whether a legally binding approach to governance is required.

- They will intensify the implementation and enforcement of EU environmental legislation.
- They will further develop a whole-of-society integrated approach to protecting biodiversity, engaging business, mobilizing private and public finance at national and EU level, guiding investment towards green recovery and implementing solutions based on nature, and enhancing knowledge, education and skills to protect and restore biodiversity.

4. An ambitious global agenda for biodiversity

The EU will contribute to this agenda by committing to work with like-minded partners in a high-ambition biodiversity coalition and provide leadership by example for an ambitious global biodiversity framework for the post-2020 period; use external action to promote the protection and restoration of biodiversity, particularly in relation to international ocean governance, trade, international cooperation, neighbourhood policy and resource mobilization.

National Biodiversity Strategy

The legal framework for the area of environmental protection stems from the Constitution of the Republic of Serbia, which defines the rights of all citizens to a healthy environment, as well as the duty of all citizens to protect and develop the environment in compliance with law. As a mechanism for the implementation of ratified international agreements in the field of biodiversity (nature) conservation, for preservation of natural values of Serbia a long-term strategic planning in accordance with the Convention on Biological Diversity (CBD) has been introduced.

The **Biodiversity Strategy of the Republic of Serbia for the Period 2011-2018** ("Official Gazette of the RS", No. 13/2011) elaborates the issue of climate change through several chapters - from recognizing it as one of the factors endangering biodiversity, to indicating the isolation of ecosystems that are expected to be the most vulnerable due to potential climate changes and defining activities for the period 2011-2018. Objectives related to climate change were also defined, primarily those related to the development of a national strategy and mechanisms for understanding, planning and, as much as possible, reducing the potential impact of climate change on biological diversity. In addition, it is pointed out the need to improve the capacity of competent authorities for monitoring and predicting the impact of climate change on biodiversity and evaluating the effectiveness of adaptation strategies and measures, as well as for raising awareness in all sectors and among the general public about the impact of climate change. One of the primary activities is the preparation and implementation of the National Action Plan for Biodiversity and Climate Change and the preparation of an assessment of the vulnerability of biodiversity to climate change in Serbia.

Regarding Natura 2000 network, the “EU for Natura 2000 in Serbia” project has been recognized as a major step towards the designation of Natura 2000 for the improvement of nature protection. The general goal of the project "EU for Natura 2000 in Serbia" is to increase the efficiency of the Republic of Serbia in preparation for the accession to the EU in the field of nature protection. One of the main requirements that acceding countries must fulfil in the field of nature protection is the establishment of the Natura 2000 network, a list of sites designated by each member state within two European directives; Birds and Habitats Directives, to ensure the long-term survival of the most valuable species and habitats.

Support to the Ministry of Environmental Protection Support will be provided to the Ministry of Environment and other relevant national and provincial institutions to establish a first list of potential Natura 2000 sites (SPA and pSCI), together with an information system, database and GIS for Natura 2000. Recommendations will be provided to harmonization of Serbian legislation with EU directives related to nature protection and improvement of technical and administrative capacities for the implementation of laws on nature protection.

The project that has provided the Ministry of Environmental Protection, the Institutes of Nature Conservation and other stakeholders with support in establishing the Natura 2000 network in Serbia has been ended on the 30th of November 2021. The extensive activities of the experts and stakeholders included field works, data analyses and identification of potential Natura 2000 sites, development of IT tools and procedures for data management, analysis and improvements of the legal framework, capacity building and preparation of management plans. It also included various activities aiming to raise public awareness and knowledge about Natura 2000 and biodiversity protection. The project identified 277 potential Sites of Community Interest (pSCIs) and 85 Special Protection Areas (SPAs) during the last two and half years of implementation – that is the main result of work performed by a team of more than 30 international and national experts.

- **European Landscape Convention or Florence Convention**

The Member States of the Council of Europe recognizing that the landscape plays an important role of public interest in the cultural, ecological, environmental and social fields, that it constitutes a resource that favours the development of economic activity, and that its protection, management and planning can contribute to the creation of jobs, they envisioned the provision of a new institutional tool dedicated exclusively to the protection, management and planning of all landscapes in Europe. A landmark in this process of recognizing the landscape as a matter of pivotal importance for the historical and political process was the signing of the European Landscape Convention or Florence Convention in 2000. The European Landscape Convention is the most important international law convention for the landscape, as it is entirely dedicated to it and its protection. The purpose of this Convention is to promote the protection, management and planning of the landscape, as well as the organization of European cooperation in related matters. The Convention consists of four chapters, of which the first defines the concepts used in the Convention, the second is dedicated to measures that the contracting parties are obliged to implement at the national and local level, the third refers to measures that encourage cooperation at the regional level and finally, the fourth refers to provisions concerning the structure and operation of the Convention.

- **Water Management Strategy**

The Water Framework Directive 2000/60/EC introduces an integrated and comprehensive approach and is an innovative step for the management of water resources in Europe. It streamlines and modernizes existing water legislation by setting common – European and broad water targets. The key objectives of the Directive as summarized in Article 1 represent a holistic approach to water management that includes the entire water cycle, surface and underground, along its flow to coastal zones and the sea. Objectives as stated in Article 4 is that the Member States (MS) should implement all the actions and actions to achieve the good status of the underground and surface water bodies and in addition to prevent the deterioration of the status of the water systems .The Directive creates the framework for the maintenance and protection of the quantity and quality which:

- prevents further degradation and protects and improves the status of all water resources.
- promotes sustainable water management, through the long-term protection of available water resources.
- strengthens the protection of the aquatic environment by implementing measures to reduce the discharge of pollutants and eliminate the discharge of toxic pollutants based on a priority list;
- ensures the progressive reduction of groundwater pollution ν contributes to dealing with the effects of extreme events, floods and droughts.

To achieve this goal, a series of regulations are established in order:

- achieve the maintenance or restoration of good surface and groundwater status by 2015 or later by 2021 (during the 1st revision of the Plan).
- consolidate and complement European water legislation;
    - approach the management of water resources at the level of a water district, which is understood to consist of one or more neighbouring watersheds together with the associated groundwater and coastal waters, designating the competent authority for its exercise;
    - manage water resources based on programs - water district management plans, which will be drawn up by each MS and which will include the general description

of the characteristics of the area, the effects of human activities on the quantity and quality of water resources, the uses of water etc.;

- to ensure realistic pricing of all services related to the use of water.

National Water Strategy

According to the Water Law, the Water Management Strategy of the territory of the Republic of Serbia until 2034 ("Official Gazette of the RS", No. 3/2017) is a master planning document that will serve as basis for the implementation of water sector reforms through the year 2034, aimed at achieving needed water management standards at the national, regional and local levels, and at fulfilling water management objectives. This Strategy also proposes the structural and non-structural measures required to achieve set objectives and outlines the needed funding, the implementation timetable, and the functions whose proper performance will govern the effective achievement of objectives. Additionally, the Strategy sets forth priority projects.

The water management concept is based on the main natural characteristics of the territory of the Republic of Serbia, the present status of water resources and water management, and the need to meet the water demand, protect water resources and ensure protection against the adverse effects of water, keeping in mind the requirement to align with international standards in this field (particularly with those of the European Union), while honouring international commitments.

Water management issues are regulated, and their primary objectives are also closely related to the public water supply; irrigation; water pollution control (water protection); protection against the adverse effects of water: river floods, erosion and flash floods; drainage. The water management policy is founded upon the following basic principles: water is an irreplaceable, renewable resource, a precondition for proper functioning and development of society and a prerequisite for the survival of the natural environment and the entire human community, whereby the management of water resources and water infrastructure constitutes a national interest and direct obligation; water resources are natural assets owned by the Republic of Serbia and, as such, cannot be removed from public property, but concessions and usage rights over them may be acquired; water resources must be managed in an integrated manner, based on the principle of sustainable development, with Serbia constituting a single territorial entity for the purposes of water management; public water supply is in the public interest and has priority over all other types of water use.

The basic postulate in defining long-term protection measures against the harmful effects of water and floods in the Strategy is that an integral solution must be defined at the level that is technically feasible, economically and ecologically justified and sustainable in conditions of climate change. Bearing in mind the lessons learned from the floods of 2014, priority works on the completion of the flood protection system along the Sava and Danube rivers, in the Kolubara and Velika Morava basins, were highlighted.

- **Waste Management Program in the Republic of Serbia for the period 2022-2031 ("Official Gazette of RS", No. 12 /2022)**

The Waste management program in the Republic of Serbia for the period 2022-2031 was preceded by the Waste Management Strategy for the period 2010–2019 ("Official Gazette of RS", number 29/10), on the basis on which the conditions for the establishment and development of an integrated system are set of waste management in the Republic of Serbia. Progress in the previous period was achieved in harmonizing regulations in the field of waste management with EU regulations, on institutional strengthening and the achievement of regional agreements for the establishment joint waste management, as well as the construction of a number of sanitary landfills.

The objectives set by the Strategy have not been fully achieved, primarily in the scope of: organized waste collection, level of primary waste separation and recycling, construction of infrastructure and the cessation of waste disposal in unsanitary landfills and garbage dumps, applying economic instruments and establishing a sustainable system financing of waste management. As the planned objectives of the previous plan document have not been fully achieved and how it happened in the meantime setting new EU objectives in the area of waste management within the "green transition" in order to move to a circular economy in the EU, it is necessary to establish new one's objectives in the field of waste management in the Republic of Serbia which represents a continuation in the direction determined by the Strategy from 2003. The priorities are the establishment of a system for the management of hazardous industrial waste: the construction of regional warehouses and plants for physical and chemical treatment of hazardous waste.

2.2.3 NATIONAL LAWS AND REGULATIONS

At the beginning of 2021, the Republic of Serbia introduced reforms of the national legal framework in the field of energy and climate change, as a starting point for the process of energy transition towards climate-neutral development. More complete alignment with the regulations of the Third Energy Package of the EU energy legislation and certain provisions of the EU package Clean Energy for All Europeans was carried out. The Republic of Serbia adopted a new legal package consisting of **the Law on Energy[3], the Law on Energy Efficiency and Rational Use of Energy[4], The Law on the Use of Renewable Energy Sources[5], the Law on Mining and Geological Research[6], as well as the Law on Climate Change[7]. Amendments**

[3]Official Gazette of the RS, no. 145/2014, 95/2018 and 40/2021
[4]Official Gazette of the RS, no. 40/21
[5]Official Gazette of the RS, no. 40/21
[6]Official Gazette of the RS, no. 101/2015, 95/2018 - other laws and 40/21
[7]Official Gazette of the RS, no. 26/21

to the Law on Energy are expected to be made by the end of 2023, and the Public Debate on the Draft Law on Amendments to the Law on the Use of Renewable Energy Sources ended on February 9, 2023.

Law on Energy ("Official Gazette of the RS", No. 145/2014 and 95/2018 - other law and 40/2021), regulates the objectives of the energy policy and the way of implementing the policy, conditions for regular and high-quality supply of energy and energy products to customers and conditions for the safe supply of customers, the protection of customers of energy and energy products, conditions and methods of performing energy activities, conditions for the construction of new energy facilities, the use of renewable energy sources, incentive measures and the guarantee of origin, the way of organizing and functioning of the electricity, natural gas and oil market companies and oil derivatives, as well as the rights and obligations of market participants.

Law on energy efficiency and rational use of energy ("Official Gazette of the RS", No. 40/2021), regulates the conditions and method of efficient use of energy and energy sources; policy of efficient use of energy; energy management system; energy efficiency policy measures: energy use in buildings, energy activities and end customers, for energy facilities and energy services; energy labelling and eco-design requirements; financing, incentives and other measures in this areas; establishment and operations of the Directorate for Financing and Encouraging Energy Efficiency, as well as other issues of importance for the rights and obligations of natural and legal persons in connection with efficient using energy.

One of the most significant innovations brought by LEERUE is the legal basis for the establishment of the Directorate for Financing and Promoting Energy Efficiency (EE Directorate). The EE Directorate was established at the end of 2021 as a separate legal body within the MoME, to carry out executive and expert operations related to the financing of efficient energy use, and its operation started in February 2022. The tasks of the EE Directorate are laid down in the Article 73 of the LEERUE.

In the previous period, the Republic of Serbia has adopted four **National Energy Efficiency Action Plans (NEEAPs)** for the periods of 2010 – 2012, 2013 – 2015, 2016 – 2018 and 2019 – 2021, respectively. These documents in the previous period set targets for energy efficiency improvements and defined measures for the achievement thereof. The latest Fourth Action Plan for Energy Efficiency (4th EEAP) of the Republic of Serbia for the period until 2021 was prepared in accordance with the requirements of Directive 2012/27/EU adopted by the Ministerial Council of the Energy Community.

Law on the Use of Renewable Energy Sources ("Official Gazette of RS", No. 40/21, 35/23) regulates the use of energy from renewable sources, objectives of using energy from renewable sources, method of determining the share renewable energy sources of the Republic of Serbia in gross final consumption energy, integration of energy from renewable sources on the market, systems incentives for the production of electricity from renewable sources, guarantees origin of electricity, production of electricity from renewable sources for own consumption, use of renewable energy sources in areas of thermal energy and areas of traffic, special procedures that related to the construction and connection of the energy facilities they use renewable energy sources, basics of cooperation mechanisms with other countries in the field of renewable energy sources, supervision over the implementation of this law, as well as other issues of importance for renewable energy sources.

The Law on Mining and Geological Research ("Official Gazette of the RS", No. 101/2015, 95/2018- other Law and 40/2021) which regulates the measures and activities of the mineral policy and the manner of its realization, policy of development of geological research and mining, conditions and method performing geological surveys of mineral and other geological resources, investigations of the geological environment, as well as geological investigations for spatial and urban planning, design, construction of facilities and rehabilitation and recultivation of terrain, method of classification of resources and reserves of mineral raw materials and underground water and geothermal resources, exploitation of mineral reserves raw materials and other geological resources, construction, use and maintenance mining facilities, plants, machines and devices, performing mining works, management of mining waste, rehabilitation and recultivation procedures of abandoned ones mining facilities, as well as supervision over the implementation of this law.

The Law on Climate Change ("Official Gazette of the RS", No. 26/2021), where through the implementation of the Law on Climate Change, that applies to the emissions of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), fluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3), the Republic of Serbia should establish a system for reducing GHG emissions and ensure adaptation to changed climate conditions. The Law regulates the system for limiting GHG emissions and for adapting to changed climate conditions, monitoring and reporting on the strategy of low-carbon development and its improvement, adaptation program to changed climate conditions, adoption of low-carbon development strategy and adaptation program to changed climate conditions, issuance of permits for GHG emissions to the plant operator, issuance of approval to the aircraft operator's monitoring plan, monitoring, reporting, verification and accreditation of verifiers, administrative fees, monitoring and other issues of importance for the limitation of GHG emissions and adaptation to changed climate conditions.

The provisions of the law apply to the procedure for issuing, revoking, amending and supplementing the GHG emission permit, the procedure for granting approval and approval for changes to the GHG emission monitoring plan, the procedure for granting approval for reports on improvements in the GHG emission methodology, and the procedure for keeping records and registers prescribed by this law regulates the general administrative procedure, unless otherwise prescribed by this law.

Establishing mechanisms for timely, transparent, accurate, consistent, comparable and thorough reporting and verification of information on meeting the requirements of the UN Framework Convention on Climate Change, the Kyoto Protocol, the Doha Amendment to the Kyoto Protocol and the Paris Agreement, as well as for monitoring and reporting on GHG emissions gardens caused by human activity from sources and removed from sinks and through adaptation activities to changed climatic conditions, undertaken in an economical way.

There are numerous other Laws and regulations of the Republic of Serbia that are to be considered, the most important of which are:

- **Air Protection Law** ("Official Gazette of the RS", No. 36/09, 10/13 and 26/21), which regulates the achievement of the basic objectives of air protection by avoiding, preventing and reducing pollution that affects ozone depletion and climate change.
- **Law on Forests** ("Official Gazette of the RS", No. 30/2010, 93/2012, 89/2015 and 95/2018 - other law), which regulates the preservation, protection, planning, cultivation and use of forests, management of forests and forest land. This law provides the conditions for sustainable management of forests and forest land as goods of public interest, in a way and to an extent that permanently preserves and increases their productivity and ability to mitigate climate change.
- **Law on Water** ("Official Gazette of the RS", No. 30/2010, 93/2012, 101/2016, 95/2018 and 95/2018 - other law), which regulates water protection, protection against harmful effects of water, use of water and water management as a good of public interest, the conditions and manner of performing water management activities, the organization and financing of water management activities and supervision over the implementation of the provisions of this law. In addition, the law stipulates that wastewater should be managed in an appropriate manner and in accordance with this law and special laws which the protection of the environment is regulated, respectively, the regulations resulting from them.
- **Law on Environmental Protection** ("Official Gazette of RS", No. 135/04, 36/09 and 72/09, 43/2011 - decision of the Constitutional Court, 14/2016, 76/2018, 95/2018 - other law and 95/2018 - other law), which regulates the integral system of environmental protection that enables people to exercise their right to life and development in a healthy environment and in a balanced relationship between economic growth and the environment in the Republic of Serbia. The environmental protection system consists of measures and instruments for sustainable management, preservation of natural

balance, integrity, diversity and quality of natural values, as well as prevention, control, reduction and elimination of all forms of environmental pollution.

- **The Law on Nature Protection** ("Official Gazette of RS", No. 36/09, 88/10, 91/10, 14/16, 95/18, 71/21), which regulates the protection and preservation of nature, biological, geological and landscape diversity as part of the environment. The objectives achieved by this law are the harmonization of human activities, plans, programs, bases and projects of economic and social development with sustainable use of renewable and non-renewable natural resources and long-term preservation of natural ecosystems and natural balance; sustainable use and/or management of natural resources and goods, ensuring their function while preserving natural values and the balance of natural ecosystems; timely prevention of human activities and operations that can lead to permanent impoverishment of biological, geological and landscape diversity, as well as disturbances with negative consequences in nature and establishing and monitoring the state of nature and improving the state of disturbed parts of nature; and landscapes.
- **The Law on Agricultural Land** ("Official Gazette of RS", No. 62/06, 65/08 41/2009, 112/2015, 80/2017 and 95/2018 - other law), which regulates the planning, protection, arrangement and use of agricultural land as well as other issues of importance for the protection and use of agricultural land, as a good of public interest.
- **The Law on Strategic Environmental Assessment** ("Official Gazette of the RS", no. 135/04 and 88/10), which regulates the conditions, method and procedure for assessing the impact of individual plans and programs on the environment in order to ensure protection environment and promotion of sustainable development by integrating the basic principles of sustainable development into the procedure of preparation and adoption of plans and programs. The process of strategic impact assessment involves the preparation of reports and results in the decision-making process and the adoption or adoption of individual plans and programs, as well as the provision of information and data on the decisions made.
- **The Law on Environmental Impact Assessment** ("Official Gazette of RS", No. 135/04 and 36/09), which regulates the impact assessment procedure for projects that may have a significant impact on the environment, the content of the environmental impact assessment study, participation of interested parties and organizations and public, cross-border notifications of projects that may have a significant impact on the environment in another country, monitoring and other issues of environmental importance.

- **The Law on Integrated Prevention and Control of Pollution** ("Official Gazette of the RS", No. 135/04, 25/15 and 109/21), which regulates the conditions and procedure of the integrated permit for energy plants and activities that may negatively affect human health, the environment or material goods, types of activities and facilities, supervision and other matters of importance for the prevention and control of environmental pollution.
- **The Law on Waste Management** ("Official Gazette of RS", No. 36/09, 88/10, 14/16,95/18, 35/2023-68 defines the field of waste management as an activity of public interest, regulates the types and classification of waste; waste management planning; entities of waste management; responsibilities and obligations in waste management; organization of waste management; management of special waste streams; conditions and procedure for issuing a permit; transboundary movement of waste; waste reporting and database; financing and supervision of waste management and other matters of importance for waste management.
- **The Law on Packaging and Packaging Waste** ("Official Gazette of the RS", No. 36/2009 and 95/18 other law), which regulates the environmental protection conditions that packaging must meet in order to be placed on the market, management of packaging and packaging waste, reporting on packaging and packaging waste, economic instruments, as well as other relevant issues for packaging and packaging waste. The use of packaging waste in the process of recycling or reuse has a significant impact on reducing the amount of waste disposed of in landfills. With this fact, this law, although it does not mention climate change, affects the reduction of GHG emissions.
- **The Law on Planning and Construction** from 2009 ("Official Gazette of the RS", No. 72/2009, 81/2009 - corrected, 64/2010 - US decision, 24/2011, 121/2012, 42/2013 - US decision, 50/2013 - US decision, 98/2013 - US decision, 132/2014 , 145/2014, 83/2018, 31/2019, 37/2019 - other law and 9/2020) defines the obligation to issue a certificate, i.e. the obligation to design, build, use and maintain a building in a manner that ensures prescribed energy performance. In addition, the amendments to the Law on Planning and Construction completed in 2020 establish the legal basis for the development and adoption of the Long-Term Strategy for Encouraging Investments in the Reconstruction of the National Building Fund of the Republic of Serbia until 2050 ("Official Gazette of the RS"; number 27/ 22). The public discussion of the Draft Law on Amendments to the Law on Planning and Construction was completed on February 20, 2023.
- The new **Law on Public Procurement (**"Official Gazette of the RS", no. 91/19) provides the price-quality relationship including qualitative, environmental and/or social criteria, as well as the implementation of a cost-effectiveness approach, such as life

cycle cost of goods, services or works. In this context, Republic of Serbia adopted the Public Procurement Development Program for the period 2019-2023, ("Official Gazette of the RS", no. 82/19) which provides specific priorities on public procurement system taking into account the relevant EU strategy and focusing on green and social field.

2.3 STUDY AREA

In this Strategic Environmental Impact Study, the entire country is defined as the study area, which is the widest area of the INCEP's geographical scope, in which environmental impacts are expected from the implementation of the planned actions.

The Republic of Serbia is located north of the equator (has north latitude) and east of Greenwich (has east longitude). It is located between 41°53' and 46°11' N and 18°49' and 23°00' E. The 45th parallel (Ruma - Pazova – Bela Crkva) crosses the territory of Serbia, so that Serbia is located in the middle of the northern hemisphere of the Earth, equally far from the equator and from Greenwich. Serbia is a continental country (it has no access to the sea).

The Republic of Serbia has a favourable traffic-geographical and geostrategic position. It is located (according to Greenwich) between 41°53' and 46°11' north latitude and 18°49' and 23°00' east longitude. Serbia is a continental country, located in South-eastern Europe, in the central part of the Balkan Peninsula. Serbia is located at the point of crossing of large European regions, that is, at the crossroads of Eastern and Western Europe. European transport corridors VII (Danube) and X (road and railway) cross its territory. It covers an area of 88,499 km2. It borders Bulgaria to the east, Romania to the northeast, Hungary to the north, Croatia and Bosnia and Herzegovina to the west, Montenegro to the southwest, and Albania and North Macedonia to the south. The total length of the state border of Serbia is 2,358.3 km. Of that, 1,609.4 km (68.2%) are land-based, and 748.9 km (31.8%) are river or lake borders. The natural border of Serbia consists of three international navigable rivers, the Danube - towards Croatia and Romania, the Sava - towards Bosnia and the Tisza River. The river border is also formed by the Drina River towards Bosnia and Herzegovina.

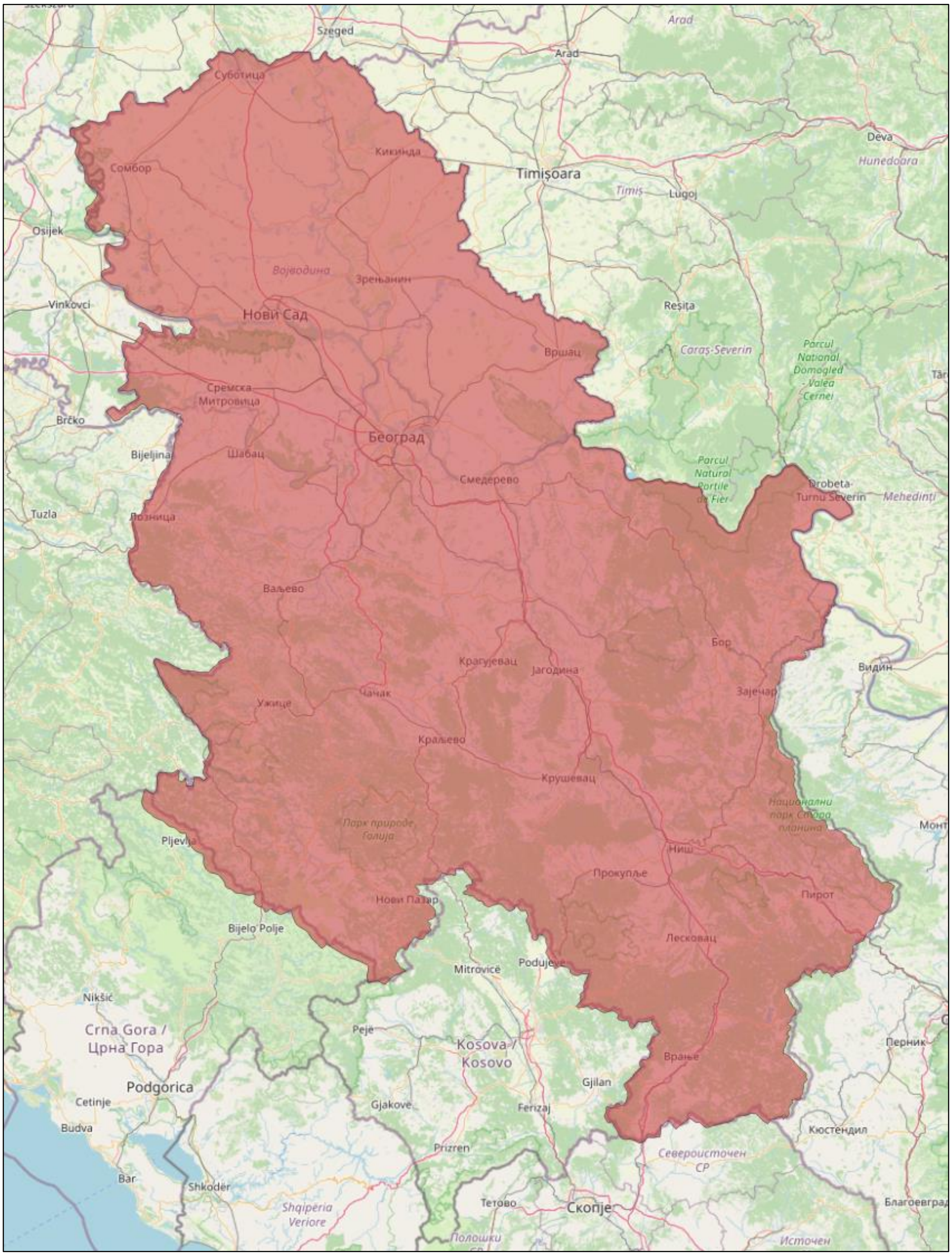


Figure 2.4: Position of Republic of Serbia

3 BACKGROUND INFORMATION FOR THE STRATEGIC ENVIRONMENTAL ASSESSMENT

3.1 DESCRIPTION OF THE INTEGRATED NATIONAL ENERGY AND CLIMATE CHANGE PLAN 2030 WITH A VISION TO 2050

The process of drafting and preparing the Integrated National Energy and Climate Plan (INECP) was implemented within the project "Further Development of Energy Planning Capacity", which was launched in February 2021. After the identification of relevant institutions, bodies and companies, Working Groups were formed.

The Government of the Republic of Serbia represents the State Authority for adoption, in accordance with the Law on Energy, while the Ministry of Mining and Energy is responsible for making decisions and creating policies related to the INECP. During the drafting and preparation of the INECP, an independent Consultant provided technical support to the Ministry of Mining and Energy, as well as to other institutions and bodies involved in the process, Finally, responsibility for project progress is assigned to the Project Steering Committee, which is an implementation and monitoring body composed of various government institutions.

The proposed INECP has taken a holistic approach and deals in an integrated way with five closely related and mutually reinforcing areas of the Energy Union:

- **Decarbonisation**: a specific area reflecting the country's commitment to climate actions and decarbonisation of the economy, with a special focus on the increased use of renewable energy sources and the reduction of the carbon footprint.

  c. **Greenhouse Gas (GHG) Emissions:** A sub-area linked to the objective of reducing energy-related and non-energy-related emissions, in line with the country's commitments.

  d. **Renewable Energy Sources (RES):** the sub-area reflecting the country's commitment to boost the deployment of renewables by keeping up with increasing energy consumption and addressing the transformation issue of the existing energy system in terms of technology transition.

- **Energy efficiency**: a specific sub-area related to the aim of the country's commitment to increase energy efficiency across all sectors.

- **Energy security**: a specific area reflecting the country's commitment to the diversification of energy sources and ensuring security of supply through solidarity and cooperation between the EU and the Energy Community (EnC) countries.
- **Internal energy market**: a specific area reflecting the country's commitment to create a fully integrated and functional market, enabling the free flow of energy through the EnC and the EU with adequate infrastructure and free of technical or regulatory barriers.
- **Research, Innovation and Competitiveness:** a specific area linked to the country's commitment towards supporting breakthroughs in low-carbon and clean energy technologies.

3.1.1 Key Objectives of National Energy and Climate Change Plan 2030 with a Vision up to 2050

The main pillars of the INECP comprise a high penetration of RES in Serbia's energy mix along with targeted energy efficiency measures aiming to reduce the final energy consumption by increasing energy performance. This clean energy transition pathway enhances the country's energy security, safeguards its energy dependency while ensuring a realistic lignite phase out, contributing to a **meaningful reduction of GHG emissions by 2030**.

The **increased penetration of RES** will constitute one of the most important objectives of the INECP for the Republic of Serbia reaching a 33.6% share in the gross final energy consumption. RES will be considered as the major domestic source of electricity production with a share exceeding 45% of the gross final electricity consumption in 2030, achieved mainly through the most cost-effective exploitation of the available potential in the case of wind and photovoltaic energy.

The efficient, regionally integrated operation of the new day-ahead electricity market, including the importance of merging the regional electricity market with the European electricity market, the simplification and acceleration of the licensing procedure, the digitization of the energy system, the enhancement and expansion of the existing electricity grid and its interconnections, the market uptake to energy storage, distributed RE and demand response resources, as well as the gradual electrification and the energy coupling of final consumption sectors are considered as prerequisites for the maximum penetration of RES.

The increased interest of investors in Wind and PV installations, as evidenced by the large number of applications, is expected to ensure that the required new capacities will be installed by 2030 and the increase of the share from 30% in 2021 to 45% in 2030 will be achieved.

Another priority is the promotion of electromobility, which will considerably rely on the electricity production by RES, while considerable energy savings are expected to be achieved, thereby simultaneously contributing to the attainment of the energy efficiency targets. Finally, the further exploitation of RES for the coverage of the thermal and cooling needs in buildings, the penetration of RES distributed technologies for electricity production and the promotion of advanced biofuels in transport sector constitute additional priorities within the framework of the INECP for the further deployment of RES.

In addition, the **promotion of energy efficiency** comprises a fundamental priority highlighting the necessity of implementing policies and measures that in turn demonstrate the most economically and socially effective approach for all end-uses. It is expected the final energy consumption in 2030 will amount to 9.6 Mtoe, while the primary energy consumption will be equal to 14.68 Mtoe in 2030. It should be noted that the improvement of the energy efficiency is associated with multiple additional benefits, such as the reduction of the GHG emissions, the reduction of the energy costs, the improvement of the comfort conditions in buildings, the increase of the value added and employment, the improvement of businesses' competitiveness and the reduction of poverty.

The **renovation of the buildings** is expected to contribute meaningfully to fulfilling the energy efficiency targets. Targeted policies and measures will be initiated to foster a renovation rate equal to 1% approximately on annual basis for the case of the residential buildings (according to the provisions of the Long-Term Buildings Renovation Strategy), 3% for the public buildings and 2.3% for the other non-residential buildings. Similarly, policies and measures are foreseen for the industrial and transport sectors focusing on the promotion of the most cost-effective technologies and vehicles respectively.

The **optimal use of available public and own financial sources** is emphasized, ensuring the maximization of the triggered benefits for final consumers taking due consideration of the specificities of each category of final consumers and of the characteristics of the energy sector.

Another essential objective within the framework of the INECP is the served by the programme for **reducing the share of lignite in electricity production**, i.e., the lignite phase-out, by up to 25% in 2030 compared to 2019. The lignite phase-out in Republic of Serbia will be implemented with targeted initiatives including the adoption of integrated programmes for supporting the lignite-producing areas and ensuring the smooth transition to the post-lignite era.

All the specified objectives of the INECP are designed to contribute to the **meaningful reduction of the GHG emissions by 2030** attaining a GHG emission reduction equal to 13.2% compared to 2010 level i.e., 33,3% compared to 1990 by 2030 (excluding non-energy related emissions from agriculture, waste, land use, land use change and forestry). The target for the overall emissions reduction for 2030 is 40.3% compared to the 1990 levels (including LULUCF). The Republic of Serbia has decided to support the transition towards a climate neutral economy to improve the competitiveness of the economy, increase employment, strengthen the role of consumers and improve the overall operational framework of competitive energy markets and increasing social welfare.

In this context, **additional national objectives** are also being developed taking into consideration the existing potential, the technical specificities and the qualitative characteristics of the Serbian energy sector and economy.

More specifically, the following qualitative objectives have been set:

- Strengthen interconnectivity and security of energy supply
- Liberalize and increase competitiveness of the energy markets
- Facilitate the optimal development and operation of the energy system and energy infrastructures
- Protect and strengthen the role of consumers
- Alter the current consumption patterns and promote energy-efficient and low- emission fuels in end-users
- Strengthen the competitiveness of the national economy
- Promote the research and innovation in environmental and energy issues

It should be noted that the mobilization of significant investment funds from both the private and public sector and the combination of specialized financing mechanisms is considered as a prerequisite for the achievement of the established targets allowing the cost- and time-effective implementation of the foreseen policies and measures.

3.1.2 Overview of the INECP

INECP is a strategic document that ensures that the Republic of Serbia takes all necessary measures to reach a set of strategic objectives and sustainable development. INECP is a tool for planning, managing and monitoring the energy transition and constitutes the basis of the energy policy. The main policy priorities are presented separately in the following subsections for each dimension of INECP:

- Decarbonisation,
    - Climate change, emissions and reduction of GHG
    - Renewable Energy Sources (RES)

- Energy efficiency,
- Energy security,
- Internal energy market,
- Research, innovation and competitiveness.

3.1.2.1 CLIMATE CHANGE EMISSIONS AND REDUCTION OF GHG

A central objective of INECP is to **reduce GHG emissions** by 40.3% in 2030 compared to 1990 including agriculture, waste and LULUCF. This is consistent with the targets set in the recently updated Nationally Determined Contribution (NDC). A well-balanced mix of policies and measures are proposed to be launched to reduce GHG emissions across the supply and demand sectors.

Priority is also given to **climate change adaptation**, as the Republic of Serbia will develop and adopt the National Strategy for Adaptation to Climate Change, which will specify general objectives, guidelines and means of implementation within the framework set by the United Nations Framework Convention on Climate Change, EU Directives and international experience.

Finally, **circular economy and bioeconomy is to be promoted,** which will also contribute to the achievement of the climate change mitigation objective. The shift to a circular pattern can lead to significant reduction of GHG emissions through recycling and reuse of materials, more efficient use of resources and more environmentally friendly product design, as well through the introduction of new circular economy models, especially in industry, transport and the built environment.

3.1.2.2 RENEWABLE ENERGY SOURCES

The national objective for the **penetration of RES** has been specified within the INECP. More specifically, the RES share in the gross final energy consumption should amount at least to 33.6% in 2030. Additional objectives have been set so that the share of RES in the gross final electricity consumption reaches at least 45.2%, the share of RES in covering heating and cooling demand 41.4% and the share of RES in the transport sector to reach 7% in alignment with the relevant EU calculation methodology.

The specified objectives for **the penetration of RES are related directly to the evolution of final consumption necessitating the achievement of the relevant energy efficiency targets**. Apparently, the key pillar for fulfilling the national objective for the penetration of RES is the contribution of RES in the electricity consumption posing the highest demand for the timely and efficient implementation of the planned policies and measures.

The **electrification and the coupling of the final consumption sectors** are also promoted in order to increase the share of RES in the final energy consumption. Initially, the **gradual electrification of the transport sector** comprises a major challenge until 2030. More specifically, a considerable penetration of electric vehicles is expected to substantially influence a number of dimensions in the INECP. The aim is to achieve this penetration at the most cost-effective approach for the national economy, while ensuring that certain prerequisites for the electrification of the transport sector, such as the simultaneous development of the charging infrastructure and the adoption of the regulatory framework are timely fulfilled.

Moreover, the **sector coupling** will contribute to the maximization of the RES in the different end-uses and, the electrification of different end-uses is an essential component in achieving this aim. The role of heat pumps, along with the energy storage systems and the self-consumption schemes, is critical for the fulfilment of the sector coupling. Similarly, the mixing of hydrogen or biomethane into the natural gas network will also contribute to sector coupling.

An objective has also been set for **promoting RES technologies in buildings through self-consumption and net metering schemes**. More specifically, the installed capacity of the RES technologies for electricity production (mainly Roof top photovoltaic systems) are expected to reach up to 0.5 GW in 2030 being capable of covering approximately 5% of the electricity consumption in residential sector.

New **innovative RES technologies** for electricity production will also be promoted within the INECP through pilot projects in order to assess their effectiveness, such as: hydrogen production, small wind turbines etc.

The use of RES for covering the heating and cooling demand will be achieved mainly through the **large installation of heat pumps** (approximately 7 GW), while the role of solar thermal systems, geothermal energy, and biomass is also essential.

Moreover, the **further utilization of RES in the district heating networks** will be achieved mainly through biomass (2.7 ktoe), while the gradual exploitation of other RES is intended, such as biomethane, hydrogen and geothermal energy.

Finally, the **contribution of electric vehicles** is expected to be substantial for the further promotion of RES. It should be noted that 40 thousand electric vehicles (both passenger and light-duty) approximately will be registered until 2030. Last but not least, the contribution of biofuels will remain dominant, with a particularly increasing share of advanced biofuels until 2030 (49 ktoe without assuming the foreseen multipliers).

3.1.2.3 IMPROVING ENERGY EFFICIENCY

An objective with significant importance within the INECP is the **improvement of energy efficiency** managing to restrain the final energy consumption at a level that doesn't exceed 9.7 Mtoe in 2030. The same tendency is observed also for the case of primary energy consumption, which should be less than 15.9 Mtoe in 2030.

An additional **energy saving target** has been specified according to the provisions of Article 7 of Directive 2012/27/EU. Specifically, 506 ktoe of cumulative final energy savings should be achieved through the implementation of energy efficiency measures over the period 2024-2030.

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The need to **renovate the existing building stock** is indisputable, which will lead not only to significant energy and cost savings but will simultaneously improve the comfort, safety and health conditions in the renovated buildings. The renovation rates, estimated within the framework of the Long-term Strategy for Encouraging Investments in Renovation of the National Building Stock of the Republic of Serbia, in the case of residential and non-residential buildings, have been taken into consideration within the framework of the INECP until 2030 in order to ensure their full alignment and to facilitate the sufficient renovation of the building stock. Consequently, 131 thousand dwellings and 7,681 thousand m2 of non-residential buildings (excluding public buildings) will be renovated until 2030 boosting the construction industry through high added value technologies and enabling the covering of the thermal needs of the end-users with lower energy costs. It should be noted that the public sector will have an exemplary role through the renovation of public buildings, as 1,026 thousand m2 public buildings are expected to be renovated.

Finally, the implementation of planned policies and measures among end users to improve energy efficiency requires the creation of **efficient** financing mechanisms in order to increase and maximize the current levels of own funds leverage. The active involvement of the financial sector and the promotion of **innovative financing instruments**, including the promotion of energy performance contracts and energy services, are critical parameters for attaining this objective. The Energy Efficiency Directorate will play a special role for the creation and implementation of financing mechanism. The capacities of the Directorate should be strengthened in the coming period, and its legal status should be further improved. This will enable the implementation of adequate financial mechanisms for the promotion of EE. The Directorate is already implementing activities for the financing of energy efficiency improvements in households and in public sector buildings at the local level.

3.1.2.4 ENERGY SECURITY

Diversification of energy sources and fuel supplier countries is the main objective of INECP for the energy security dimension. More precisely, policies and measures are proposed to strengthen the **diversification of energy sources** in order to prevent dependence on a single fuel or a single country. The achieved diversification will increase competitiveness between fuels and suppliers from third countries which is expected to lead to reduced energy prices, enhanced security of supply and protection of the energy supply in the event of an energy crisis at regional level.

Optimal **utilization of domestic energy sources** should be ensured in order to increase energy security. The identification of the existing potential and the most cost-effective use of domestic energy sources is an essential target within the INECP. Emphasis will be placed on the use of the RES potential, both for the production of electricity and for direct use from end-users, which is expected to significantly contribute to energy security.

Strengthening the **geopolitical role** of the Republic of Serbia is another vital objective. Therefore, it is urgent to complete the existing interconnections and to design new international interconnections with pipelines from neighbouring countries. Furthermore, these actions will also contribute to the diversification of energy sources and supply routes from third countries. Several cross-border / international natural gas transportation projects will be promoted, enhancing the diversification of energy sources and, in conjunction with the promotion of natural gas storage projects, ensuring the adequacy in the case of a natural gas shortage.

Stabilizing the rate of energy dependence is another important objective within the INECP. Current energy dependence is relatively low, and it is necessary to limit it to similar levels due to the high penetration of petroleum products and, to a lesser degree, natural gas. Consequently, the energy dependency should not surpass the level of 41% in 2030.

Finally, another objective is to ensure the required electricity system adequacy in order to attain a minimum level of reliability for covering the demand for electricity, in conjunction with the decision to reduce the electricity production by lignite plants. To attain this objective, it will be necessary to adopt mechanisms for strengthening the system with additional electricity production capacity or promoting a demand response scheme.

3.1.2.5 INTERNAL ENERGY MARKET

The **market integration and the establishment of competitive energy markets** will be promoted within the dimension of the internal energy market. The necessary reforms are proposed to be initiated to harmonize the domestic electricity and natural gas markets with the EU directive and regulations for respective markets.

The **coupling of the energy markets** is expected to help increase the liquidity of the interconnected markets and enable the participation of RES in the cross-border trade of electricity.

Participation in new energy markets is expected to allow RES to balance production closer to real-time, which would reduce the need and associated costs for reserves and increase the system's security.

Another objective is to **strengthen the role of electricity market consumers** in the electricity market by increasing participation on the demand side of the electricity market, and promoting the deployment of storage systems that will ensure lower electricity and gas prices as well as increase the penetration of RES and the electricity system adequacy.

Digitization of the energy system is a prerequisite for the development of properly operating and competitive domestic energy markets and for optimal implementation and use of all technological applications and market mechanisms that can be developed in the context of energy markets. Emphasis is placed, through operational development programs, on the planning and implementation of relevant infrastructure projects, information systems, control centres and metering devices that will allow for the complete transition from the current energy system to a fully digitized one, also ensuring the secure management of the consumer data.

Alleviating **energy poverty** is an additional objective as the energy crisis has contributed to a deterioration of the situation. Reducing energy poverty by 75% in 2030 compared to 2020 is set as a national objective.

Finally, the contribution of **net metering and the local community energy scheme** is twofold, as it is expected to contribute to the implementation of RES and investments in energy efficiency, as previously presented, as well as to an improved active participation of the local community and a stronger role of consumers. The quantitative objective is specified so that the management of new self-consumption and net metering systems with an installed capacity equal to 0.5 GW (mainly Roof top photovoltaic systems) in 2030.

3.1.2.6 RESEARCH, INNOVATION AND COMPETITIVENESS

The promotion of research and innovation will continue to be a priority through the support of innovative technologies, which are expected to contribute to the fulfilment of energy and climate objectives. It is expected that annual expenditure for further research support and technological innovations will double in 2030 compared to 2020.

Improving **the energy intensity and GHG emission intensity** is expected to lead to an increased competitiveness of the Serbian economy. More specifically, the adoption of targeted energy efficiency policies and measures will contribute to both to reduce energy costs and to enhance the competitiveness of the various economic sectors.

Reducing **energy costs** are expected to make energy products more affordable for all consumers. The design of the necessary policies and measures will consider the purchasing power of consumers and the specificities of different groups, as well as any specifics related to local characteristics, such as those in rural areas. Maintaining an average cost of energy products below the European average end-user level has been set as a goal within the INECP.

The domestic **added value of the energy sector** is expected to increase through the identification and promotion of innovative applications and services in the energy sector with high domestic added value that increase the gross domestic product and the sustainability of the energy sector. In addition, this objective is expected to ensure an increase in the number of direct and indirect jobs due to activities in the energy sector.

Finally, specific policies and measures are proposed to be integrated into the Just Transition Plan for the areas **most affected by the transition to a low-carbon economy**. The challenges faced by lignite-dependent areas during the transition to a low-carbon economy are proposed to be addressed through tailored solutions to support structural transformation and accelerate the process of economic diversification and technological transition. The objective is to develop a sustainable development strategy, focusing on sectors with dynamic perspectives in terms of output, employment and income indicators.

3.1.3 Overview of Proposed Interventions

The INECP is proposes measures and interventions which involve investments for developing infrastructure (hard actions) as well as policy measures (soft actions) aimed at improving inter alia the existing regulatory framework and enhancing public awareness on the environmental impact of energy consumption with the aim of informing populations, motivating behavioural change and engagement.

3.1.3.1 POLICIES AND MEASURES

Policies and measures proposed for each of the five dimensions of the Energy Union are presented in detail under the INECP. For each policy measure, information includes its main objective and quantified objective, its descriptions, the implementation time frame, the type of measure, sectors covered/affected, the implementing entity, the monitoring entity, the selected progress indicators, other Energy Union dimension(s) affected, relevant EU and National Regulations, the implementation cost and financing source(s).

Policy measures (PM) are grouped by Union Policy Dimension and numbered as described below:

- A DECARBONISATION DIMENSION MEASURES

  - A1 Greenhouse Gas (GHG) Emissions and Reduction: **PM_D1 –D18**
  - A2 Renewable Energy Sources (RES): **PM_D19- D44**
- B ENERGY EFFICIENCY DIMENSION MEASURES: **PM_EE1 – EE44**
- C ENERGY SECURITY DIMENSION MEASURES: **PM_ES1 – ES11**
- D INTERNAL ENERGY MARKET DIMENSION MEASURES: **PM_IEM1 – IEM38**
- E RESEARCH, INNOVATION AND COMPETITIVENESS DIMENSION MEASURES: **PM_RIC1 – RIC20**

The tables below give an overview of the PMs by Union Policy Dimension, other relevant Energy Union dimension(s) affected by the PM as well as the sector(s) covered.

3.1.3.2 DECARBONISATION

Table 3.1: DECARBONISATION DIMENSION MEASURES

No.	Name of policy or measure	Type of measure	Decarbonisation		Energy efficiency	Energy security	Internal energy market	Research, innovation and competitiveness	Covered sectors
			Reduction of GHG emission	RES					
A1 Greenhouse Gas (GHG) Emissions and Reduction									
PM_D1	Preparation for and Introduction of carbon tax	Reform							All areas related to INECP
PM_D2	Adoption, Implementation and monitoring of the Low-carbon Development Strategy and Action Plan for its implementation and developing an Adaptation Plan to Climate Change	Reform							All areas related to INECP
PM_D3	Promoting circular economy	Investment							All areas related to INECP
PM_D4	Organizing awareness campaigns for better information dissemination	Investment							All areas related to INECP
PM_D5	Establishment and operation of the National Climate Change Council, a Carbon Footprint Observatory for all sectors, and a National GHG inventory system	Reform							All areas related to INECP
PM_D6	Implementation and monitoring of Just Transition and related Action Plan	Reform							All areas related to INECP
PM_D5	Implementation of technological changes in production processes in specific industries	Investment							Industry
PM_D6	Emission reduction measures in the refrigeration and air conditioning - fluorinated gas emissions	Investment							Industrial, services
PM_D14	Improvement of wastewater treatment and discharge	Investment							Waste

No.	Name of policy or measure	Type of measure	Decarbonisation		Energy efficiency	Energy security	Internal energy market	Research, innovation and competitiveness	Covered sectors
			Reduction of GHG emission	RES					
PM_D15	Improvement of waste management practices, including a decrease of biodegradable components of waste disposed on landfills and increased recycling	Investment							Waste
PM_D16	Higher percentage of municipal solid waste treated by biological treatment options	Investment							Waste
PM_D17	Utilisation of the entire amount of methane (CH4) generated from all the dumped quantities of waste that end up in sanitary landfills	Investment							Waste
PM_D18	Promotion of composting in both centralised and household perspectives	Investment							Waste
PM_D7	Sustainable forest management (forest land remaining forest land)	Investment							Agriculture, forestry and other land use (AFOLU)
PM_D8	Land conversion to cropland	Investment							Agriculture, forestry and other land use (AFOLU)
PM_D9	Increase the tree-planted areas (groves / parks / green roofs)	Investment							Agriculture, forestry and other land use (AFOLU)
PM_D10	Measures for the reduction of CH4 emissions from the enteric fermentation of animals	Reform							Agriculture, forestry and other land use (AFOLU)
PM_D11	Improvement of manure management for the reduction of CH4 and N2O emissions	Investment							Agriculture, forestry and other land use (AFOLU)
PM_D12	Measures for the reduction of direct and indirect N2O emissions from managed soils	Investment							Agriculture, forestry and other land use (AFOLU)
PM_D13	Measures for reducing emissions from fertilizers use	Investment							Agriculture, forestry and other land use (AFOLU)
A2	**Renewable Energy Sources (RES)**								
PM_D19	Support scheme based on tendering procedures (auction scheme) for commercially cost-effective RES technologies	Investment							Electricity

No.	Name of policy or measure	Type of measure	Decarbonisation		Energy efficiency	Energy security	Internal energy market	Research, innovation and competitiveness	Covered sectors
			Reduction of GHG emission	RES					
PM_D20	Application of the legislative framework for the participation of the RES producers in electricity market	Reform							Electricity
PM_D21	Support RES technologies that will not participate into the tendering procedures	Investment							Electricity
PM_D22	Provision of economic support to innovative and demonstration pilot RES projects	Investment							Electricity
PM_D23	Fostering the further utilization of guarantees of origin for energy from RES	Reform							Electricity
PM_D24	Updating, simplifying and optimizing the authorization, certification, permit-granting and licensing procedures - Establishment of One stop shop	Reform							Electricity
PM_D25	Updating, simplifying and optimizing the spatial planning framework	Reform							Electricity
PM_D26	Updating, simplifying and optimizing the grid connection procedures and setting detailed methodology and allocation rules for RES grid connection costs	Reform							Electricity
PM_D27	Fostering the self-consumption of the produced electricity	Investment							Electricity
PM_D28	Establishing publicly accessible registry for RES electricity producers	Reform							Electricity
PM_D29	Adaptation, enhancement and expansion of the grid networks for avoiding congestions and enabling the optimal penetration of RES	Reform							Electricity
PM_D30	Promotion of RES for heating and cooling in new and renovated buildings	Investment							Heating and cooling
PM_D31	Provision of fiscal and economic incentives to foster RES in heating and cooling	Investment							Heating and cooling

No.	Name of policy or measure	Type of measure	Decarbonisation		Energy efficiency	Energy security	Internal energy market	Research, innovation and competitiveness	Covered sectors
			Reduction of GHG emission	RES					
PM_D32	Facilitating the penetration of RES into district heating networks	Investment							Heating and cooling
PM_D33	Fostering the production of biofuels in transport sector	Investment							Transport
PM_D34	Fostering the consumption of biofuels in transport sector	Reform							Transport
PM_D35	Development of the required infrastructure for recharging electric vehicles	Investment							Transport
PM_D36	Provision of fiscal and economic incentives to foster the further deployment of electric vehicles	Reform							Transport
PM_D37	Promotion of renewable energy communities	Investment							Electricity, Heating and Cooling
PM_D38	Development of the legislative framework and provision of incentives for the promotion of energy storage technologies	Investment							Electricity, Heating and cooling, Transport
PM_D39	Supporting demonstration projects for the promotion of biomethane and renewable hydrogen	Investment							Electricity, Heating and cooling, Transport
PM_D40	Development of the required legislative framework and the required infrastructure for the deployment of biomethane and renewable hydrogen	Reform							Electricity, Heating and cooling, Transport
PM_D41	Development of effective supply chains for the exploitation of the available potential of biofuels, bioliquids and biomass	Investment							Electricity, Heating and cooling, Transport
PM_D42	Specification of the sustainability and GHG emissions saving criteria for biofuels, bioliquids and biomass fuels including the required monitoring and verification activities	Reform							Electricity, Heating and cooling, Transport
PM_D43	Conduction of information and training activities to all to all relevant actors for the use of RES including the development of a certification scheme for RES professionals	Investment							Electricity, Heating and cooling, Transport

No.	Name of policy or measure	Type of measure	Decarbonisation		Energy efficiency	Energy security	Internal energy market	Research, innovation and competitiveness	Covered sectors
			Reduction of GHG emission	RES					
PM_D44	Promotion of RES through green public procurements	Investment							Electricity, Heating and cooling, Transport

3.1.3.3 ENERGY EFFICIENCY

Table 3.2: ENERGY EFFICIENCY DIMENSION MEASURES

No.	Name of policy or measure	Type of measure	Decarbonisation	Energy efficiency	Energy security	Internal energy market	Research, innovation and competitiveness	Covered sectors
PM_EE1	Financing and fiscal measures for the renovation of residential buildings	Investment						Residential
PM_EE2	Financing and fiscal measures for the renovation of public buildings	Investment						Public sector
PM_EE3	Financing and fiscal measures for the renovation of non-residential buildings (not public)	Investment						Commercial, industrial
PM_EE4	Completion of legislative framework in alignment with Directive 2018/844/EU and regulatory measures to promote near-zero energy buildings (nZEBs)	Reform						Residential, public, commercial
PM_EE5	Programs for the renovation of buildings exceeding minimum energy requirements (nZEBs)	Investment						Residential, public, commercial
PM_EE6	Mandatory installation of solar thermal systems in new buildings and in buildings undergoing major renovation	Investment						Residential, public, commercial
PM_EE7	Enhancing the role of the energy performance certificates	Reform						Residential, public, commercial

No.	Name of policy or measure	Type of measure	Decarbonisation	Energy efficiency	Energy security	Internal energy market	Research, innovation and competitiveness	Covered sectors
PM_EE8	Overcoming split incentive barrier	Reform						Residential, commercial
PM_EE9	Promotion of energy efficient, lighting systems, electric appliances and office equipment	Investment						Residential, commercial
PM_EE10	Promotion of energy efficient passenger and light-heavy duty vehicles	Investment						Transport
PM_EE11	Ensuring the energy efficiency in imported used passenger cars	Reform						Transport
PM_EE12	Financing programs for the promotion of energy efficiency passenger vehicles	Investment						Transport
PM_EE13	Development of the required infrastructure for the promotion of alternative fuels	Investment						Transport
PM_EE14	Promotion of energy efficiency of the freight transport	Investment						Transport
PM_EE15	Promotion of modal shift both for passenger and freight transport - Enabling 'Mobility as a Service' (MaaS)	Reform						Transport
PM_EE16	Promotion of energy efficiency in inland waterways transport	Investment						Transport
PM_EE17	Promotion of energy efficiency in rail transport	Investment						Transport
PM_EE18	Continuous enhancement and extension of the relative infrastructure for public transport	Investment						Transport
PM_EE19	Development of sustainable regional or municipal mobility plans	Reform						Transport
PM_EE20	Supplementary actions for the promotion of energy efficiency in transport sector	Reform						Transport
PM_EE21	Support schemes for the promotion of energy efficiency in industrial sector	Investment						Industrial
PM_EE22	Regulatory measures for the promotion of energy efficiency in industrial sector	Investment						Industrial
PM_EE23	Supplementary actions for the promotion of energy efficiency in industrial sector	Investment						Industrial

No.	Name of policy or measure	Type of measure	Decarbonisation	Energy efficiency	Energy security	Internal energy market	Research, innovation and competitiveness	Covered sectors
PM_EE24	Support schemes for the promotion of energy efficiency in agricultural sector	Investment						Agriculture
PM_EE25	Advisory services and energy audits for farmers	Investment						Agriculture
PM_EE26	Promotion of energy services and energy performance contracts through targeted financing programs	Reform						Public, commercial, industrial
PM_EE27	Promotion of energy services and energy performance contracts through supplementary activities	Reform						Public, commercial, industrial
PM_EE28	Mandatory conduction of energy audits and development of energy management systems	Reform						Public, commercial, industrial
PM_EE29	Promotion of energy audits in SMEs and in households	Reform						Commercial, residential
PM_EE30	Financing programs for the energy upgrading of street lighting	Investment						Public
PM_EE31	Conduction of awareness raising activities	Reform						All final energy consumption sectors
PM_EE32	Promotion of energy-efficient products through the implementation of energy labelling and eco-design Directives	Reform						All final energy consumption sectors
PM_EE33	Promotion of green public procurements	Reform						Public
PM_EE34	Regulatory measures and financing programs for promoting/modernizing high efficient CHP units and district heating/cooling networks	Reform						All final energy consumption sectors
PM_EE35	Development of a scheme for the qualification, accreditation and certification of energy efficiency professionals	Reform						All final energy consumption sectors
PM_EE36	Promotion of energy efficiency in water supply, distribution and consumption	Investment						All final energy consumption sectors
PM_EE37	Strengthening the technical and administrative capacity of the involved policy makers	Reform						All final energy consumption sectors

No.	Name of policy or measure	Type of measure	Decarbonisation	Energy efficiency	Energy security	Internal energy market	Research, innovation and competitiveness	Covered sectors
PM_EE38	Development of sustainable and innovative financing of energy efficiency projects	Reform						All final energy consumption sectors
PM_EE39	Improve the bankability of energy efficiency projects	Reform						All final energy consumption sectors
PM_EE40	Deployment of smart meters (synergies with energy market dimension)	Investment						All final energy consumption sectors
PM_EE41	Promotion of smart and carbon neutral cities	Investment						All final energy consumption sectors
PM_EE42	Promotion of measures for improving energy efficiency in electricity infrastructure	Reform						All final energy consumption sectors
PM_EE43	Promotion of measures for improving energy efficiency in natural gas infrastructure	Reform						All final energy consumption sectors
PM_EE44	Promotion of demand response and dynamic pricing and tariffs	Reform						All final energy consumption sectors

3.1.3.4 ENERGY SECURITY

Table 3.3: ENERGY SECURITY DIMENSION MEASURES

No.	Name of policy or measure	Type of measure	Decarbonisation	Energy efficiency	Energy security	Internal energy market	Research, innovation and competitiveness	Covered sectors
PM_ES1	Gas interconnector Serbia Bulgaria (MG10)	Investment						Gas
PM_ES2	Enhancement of regional electricity and gas interconnections	Investment						Electricity, Gas
PM_ES3	Building capacities for energy storage	Reform						Electricity
PM_ES3.1	Banatski dvor, natural gas storage	Investment						Gas
PM_ES3.2	Creating mandatory reserves of oil and petroleum products	Reform						Oil
PM_ES4	Creating operational reserves of oil, coal and other energy derivatives	Reform						Oil and coal
PM_ES5	Creating mandatory natural gas reserves	Reform						Gas
PM_ES6	Electricity Risk Preparedness plan	Reform						Electricity
PM_ES7	Update in Security of supply regulation (at least at a national level)	Reform						Electricity, Gas
PM_ES8	Oil product pipeline from Pančevo refinery to Novi Sad, Sombor, Belgrade and Niš, through Smederevo and Jagodina	Investment						Oil
PM_ES9	Development of a pumped storage project in Bistrica	Investment						Electricity
PM_ES10	Development of additional dispatchable generation from natural gas	Investment						Electricity
PM_ES11	Modernisation of the coal mining industry	Investment						Coal

3.1.3.5 INTERNAL ENERGY MARKET

Table 3.4: INTERNAL ENERGY MARKET DIMENSION MEASURES

No.	Name of policy or measure	Type of measure	Decarbonisation	Energy efficiency	Energy security	Internal energy market	Research, innovation and competitiveness	Covered sectors
PM_IEM1	Implementation of Transbalkan Corridor: OHL SS Kragujevac (RS) - Kraljevo (RS)	Investment						Electricity
PM_IEM2	Implementation of Transbalkan Corridor: OHL Obrenovac (RS) - Bajina Basta (RS)	Investment						Electricity
PM_IEM3	Implementation of Transbalkan Corridor: OHL B.Basta (RS) – Visegrad (BA) – Pljevlja (ME)	Investment						Electricity
PM_IEM4	Interconnection between Resita (RO) and Pancevo (RS) (PCI 3.22.1)	Investment						Electricity
PM_IEM5	Pannonian corridor	Investment						Electricity
PM_IEM6	Central Balkan Corridor	Investment						Electricity
PM_IEM7	RES integration cluster of projects - North CSE Corridor	Investment						Electricity
PM_IEM8	Regional gas connection through the implementation of interconnection projects	Investment						Gas
PM_IEM8.1	Implementation of the Serbia-Bulgaria gas interconnection project	Investment						Gas
PM_IEM8.2	Project for Serbia-Romania gas interconnection 85.5 km (out of which 12.8 km is on the territory of the Republic of Serbia), with a capacity of 1.2 billion m3/year	Investment						Gas
PM_IEM8.3	Project for Serbia-Croatia gas interconnection (95 km, with a capacity of 1.5 billion m3/year)	Investment						Gas
PM_IEM8.4	Project for Serbia-BiH gas interconnection 90 km, with a capacity of 1.2 billion m3/year	Investment						Gas

No.	Name of policy or measure	Type of measure	Decarbonisation	Energy efficiency	Energy security	Internal energy market	Research, innovation and competitiveness	Covered sectors
PM_IEM8.5	Main gas pipeline RG 11-02 Leskovac-Vladičin Han-Vranje 71 km.	Investment						Gas
PM_IEM8.6	Gas pipeline - interconnection with Montenegro	Investment						Gas
PM_IEM8.7	Project for Serbia-Macedonia gas interconnection 70.7 km, with a capacity of 0.8 billion m3/year	Investment						Gas
PM_IEM8.8	Project for Niš-Priština gas pipeline construction 65 km, with a capacity of 0.8 billion m3/year	Investment						Gas
PM_IEM9	Investments related to the digitalisation of the networks aiming at increasing RES integration and improvement of quality of supply	Investment						Electricity
PM_IEM10	Cluster of network infrastructure projects in the wider area of Belgrade (BEOGRID)	Investment						Electricity
PM_IEM11	Smart meters roll out in electricity DSO	Investment						Residential, public, commercial, industrial
PM_IEM12	Studies for gas in smart meters roll out in natural gas distribution	Reform						Gas
PM_IEM13	Design and implement market and network data management model	Reform						Electricity
PM_IEM14	Promotion of demand response for the end-users by use of the dynamic tariff system	Reform						Electricity
PM_IEM15	Equipping gas distribution systems with metering and data collection devices (measuring equipment, measuring and operational platform, SCADA) necessary for the functioning and development of the gas market	Investment						Gas
PM_IEM16	Appointment of the Nominated Electricity Market Operator (Article 183a in accordance to the amendments of the Energy Law)	Reform						Electricity

No.	Name of policy or measure	Type of measure	Decarbonisation	Energy efficiency	Energy security	Internal energy market	Research, innovation and competitiveness	Covered sectors
PM_IEM17	Development of the regulatory framework for the operation of the “producer-consumer” (prosumer) (Article 169 in accordance to the amendments of the Energy Law and Article 58 to 61 of the Law on the use of RES)	Reform						Residential, public, commercial, industrial
PM_IEM18	Development of the regulatory framework for the operation of the “electricity storage” (Article 169 in accordance to the amendments of the Energy Law)	Reform						Residential, public, commercial, industrial
PM_IEM19	Development of the regulatory framework for the operation of the “aggregator” (Article 169 in accordance to the amendments of the Energy Law)	Reform						Residential, commercial
PM_IEM20	Development of the regulatory framework for the operation of the Renewable Energy Communities (RECs) and Citizen Energy Communities (CECs) (Article 62 to 66 and Article 77 of the Law on the use of RES)	Reform						Residential, public, commercial, industrial
PM_IEM21	Implementation of EU Network Codes and Guidelines on electricity through appropriate amendments of the secondary legislation and adoption of additional rules, decisions and acts, where applicable.	Reform						Electricity
PM_IEM22	Unbundling and Certification of Transmission System Operators	Reform						Gas
PM_IEM23	Implementation of Regulation (EU) 2017/459	Reform						Gas
PM_IEM24	Implementation of Regulation (EU) 2017/460	Reform						Gas
PM_IEM25	Implementation of Regulation (EU) 2014/312	Reform						Gas
PM_IEM26	Reform of the Wholesale market to foster competition	Reform						Gas
PM_IEM27	Further development of Retail market opening	Reform						Gas

No.	Name of policy or measure	Type of measure	Decarbonisation	Energy efficiency	Energy security	Internal energy market	Research, innovation and competitiveness	Covered sectors
PM_IEM28	Development of the Grid Code of Srbijagas. Development of a grid code for Yugorosgaz Transport	Reform						Gas
PM_IEM29	Intensify gasification efforts in Serbia	Reform						Gas
PM_IEM30	Development of regulatory framework for biomethane	Reform						Gas
PM_IEM31	Market coupling to the Single Day Ahead Market (SDAMC)	Reform						Electricity
PM_IEM32	Market coupling to the Single Intra Day Market (SIDC)	Reform						Electricity
PM_IEM33	Preparation and adoption of an action plan to ensure achievement for energy poverty reduction	Reform						Residential
PM_IEM34	Regulatory measures for the protection of energy poor households and provision of allowances for the short-term alleviation of the energy poverty (i.e. energy card or social tariff)	Reform						Residential
PM_IEM35	Preparation of special programs for the application of energy efficiency measures and the promotion of RES among energy vulnerable customers for the long-term confrontation of the energy poverty	Reform						Residential
PM_IEM36	Facilitate access to alternative energy sources among energy vulnerable and other customers in order to reduce energy poverty	Investment						Residential
PM_IEM37	Improvement of the tools and methodology for collecting data relevant to monitoring of energy poverty	Investment						Residential
PM_IEM38	Awareness and information measures for the alleviation of energy poverty	Reform						Residential

3.1.3.6 RESEARCH, INNOVATION AND COMPETITIVENESS

Table 3.5: RESEARCH, INNOVATION AND COMPETITIVENESS DIMENSION MEASURES

No.	Name of policy or measure	Type of measure	Decarbonisation	Energy efficiency	Energy security	Internal energy market	Research, innovation and competitiveness	Covered sectors
PM_RIC1	Enhancement of the legal framework to encourage Research and Innovation	Reform						All INECP subject fields
PM_RIC2	Establishment of a Joint State Aid Action on Research and Innovation in the field of Energy	Investment						All INECP subject fields
PM_RIC3	Establishment of a Multiannual Investment Plan for the strengthening of R&I infrastructures	Reform						All INECP subject fields
PM_RIC4	Integration of Serbia into the European Research Area and enhanced participation in EU's funded Energy R&I Programs	Reform						All INECP subject fields
PM_RIC5	Development of Innovation Hubs / Clusters, Start-ups, Spin-offs/Spin-outs	Investment						All INECP subject fields
PM_RIC6	Development of specialised Competence Centers	Investment						All INECP subject fields
PM_RIC7	Facilitation of the establishment of regional centres of research excellence	Investment						All INECP subject fields
PM_RIC8	Establishment and networking of Technology Transfer Offices of research organisations / institutes and Science Technology Parks	Investment						All INECP subject fields
PM_RIC9	Support the cooperation between research institutes and businesses in the technology transfer and exploitation of research results	Investment						All INECP subject fields
PM_RIC10	Development of innovative energy-saving technologies	Investment						Energy efficiency, buildings, industry
PM_RIC11	Development of innovative decarbonisation technologies, with emphasis on RES for electricity, heating/cooling production, hydrogen production,	Investment						RES, power generation by TPP, industrial processes (cement, chemical, iron and

No.	Name of policy or measure	Type of measure	Decarbonisation	Energy efficiency	Energy security	Internal energy market	Research, innovation and competitiveness	Covered sectors
	carbon capture, storage and utilisation (CCU-CCS) technologies							steel, pulp and paper, refineries, traffic, etc.)
PM_RIC12	Research on the digitization of energy networks and the development of smart grids	Investment						Consumer-focused smart energy system
PM_RIC13	Development of innovative technologies in transport and applications for micro-mobility	Investment						Sustainable transport
PM_RIC14	Development of innovative energy storage applications	Investment						Sustainable transport, smart energy system, CCUS
PM_RIC15	Promote the inter-sectoral and geographical mobility of researchers	Investment	PM_RIC15					All INECP subject fields
PM_RIC16	Enhancing education / training to support the energy transition	Investment	PM_RIC16					All INECP subject fields
PM_RIC17	Promotion of entrepreneurship through research and innovation actions which are embedded in market functions	Investment	PM_RIC17					All INECP subject fields
PM_RIC18	Optimising support framework and schemes for promoting investments with a view to strengthening competitiveness	Reform	PM_RIC18					All INECP subject fields
PM_RIC19	Strengthening competitiveness through the establishment and operation of Special Target Funds	Reform	PM_RIC19					All INECP subject fields
PM_RIC20	Promoting innovative circular economy technologies to improve businesses competitiveness	Investment	PM_RIC20					All INECP subject fields

3.2 PREVIOUS STAKEHOLDER CONSULTATION

3.2.1 Involvement of the National Parliament

Law on Strategic Environmental Impact Assessment ("Official Gazette of the RS", No. 135/2004 and 88/2010), and Law on Environmental Protection ("Official Gazette of the RS", No. 135/04, 36/09, 36/09-other law, 72/09-other law , 43/2011-US decision, 14/16, 76/18, 95/18-other law and 95/18-other law) provide provisions in order to inform the public about individual plans and programs and their possible impact on the environment, as well as ensuring full openness of the process of preparation and bringing or adopting plans and programs. In this context, before making any decisions, as well as after making plans and programs, the public should have access to information related to those plans and programs, as well as their amendments.

The provisions of the Law on Energy do not provide for the participation of the Parliament in the process of preparing or adopting the Integrated National Energy and Climate Plan of the Republic of Serbia. In accordance with Article 8a of the Law on Energy, the Integrated National Energy and Climate Plan of the Republic of Serbia is adopted by the Government of the Republic of Serbia.

3.2.2 Involvement of Local and Regional Authorities

Since the implementation of energy and climate objectives must be achieved with bottom-up support and a top-down approach to planned activities, the preparation of the INECP focuses on the inputs of local and regional government.

Local and regional authorities were involved in the preparation of the INECP on an ad hoc basis, providing the necessary data for certain areas and giving their opinion on certain issues to support the planning process. In order to achieve a comprehensive and harmonized planning at the national and local level in the early stages of development and preparation of the INECP , the main planning conclusions implemented at the local level were taken into account, such as the Action Plan of the City of Belgrade Green City and the Action Plan of the City of Belgrade for Sustainable Energy and Climate for the period up to 2030. Finally, it is worth mentioning that relevant stakeholders at the local and regional levels will be officially invited to participate in the public consultation process so that they may provide their contributions.

3.2.3 Stakeholder Consultations, Including Social Partners, Engagement of Civil Society and the General Public

In early 2021, two Working Groups were established, composed of numerous representatives of the relevant institutions and major companies from the public and private sectors. Specifically, WG1, which is analytical-orientated and responsible for modelling work and WG2 which is policy-orientated and tasked with the drafting of the INECP. The overall process of the development and preparation of the INECP is coordinated by the Ministry of Mining and Energy, being the leading Ministry for document preparation and key beneficiary of the above-mentioned project.

The following figure presents the structure of working groups by involved subjects during the drafting process INECP.

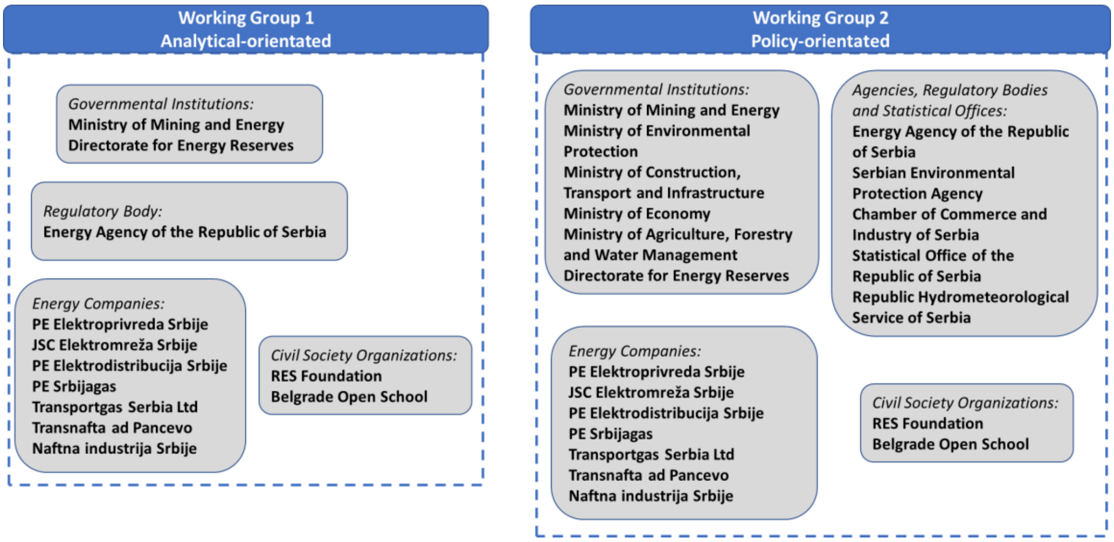

Figure 3.1: Structure of the Working Groups per entities involved

Initially, the working groups consisted of 19 national actors and a total of 83 representatives. Stakeholders are: 6 governmental institutions (5 ministries and the Directorate for Energy Reserves, including the Deputy Prime Minister), 6 stakeholders representing agencies, regulators and the Bureau of Statistics, and 7 energy companies. In order to ensure that representatives of civil society regularly participate in the process of drafting and preparing the INECP, the working groups were subsequently expanded. A public invitation to civil society organizations for membership in the working groups of the Ministry of Mining and Energy was extended in 2021. Thus, representatives of the RES Foundation, the Belgrade Open School (BOS) and the Centre for Ecology and Sustainable Development (CEKOR) joined, WG1 and WG2 as regular members.

Additionally, in order to secure high quality of planning, mitigate gaps and fully mobilize existing national capacities, the overall process is constantly supported by a number of relevant bodies, such as various business associations, research institutions and others, on ad hoc basis for particular issues. The concept of the decision-making process, discussion sessions and overall communication is realized through the Working Group meetings that have been held regularly, but also through the introduction of the regularly conducted so-called “dimensional meetings”, dedicated to each of the five dimensions (i.e. Decarbonization, Energy Efficiency, Internal Energy Market, Energy Security, and Research, Innovation and Competitiveness) and with aim to elaborate each dimension in details. Due to the limited timeframe for the elaboration of the INECP and the rather demanding organizational effort, there is no strict definition or establishment of sub-groups along the five dimensions of the Energy Union, but their participation has been unofficially allocated as per their responsibility and relevance.

The detailed scheme of the relevant participants per dimension within the project is presented in the following figure:

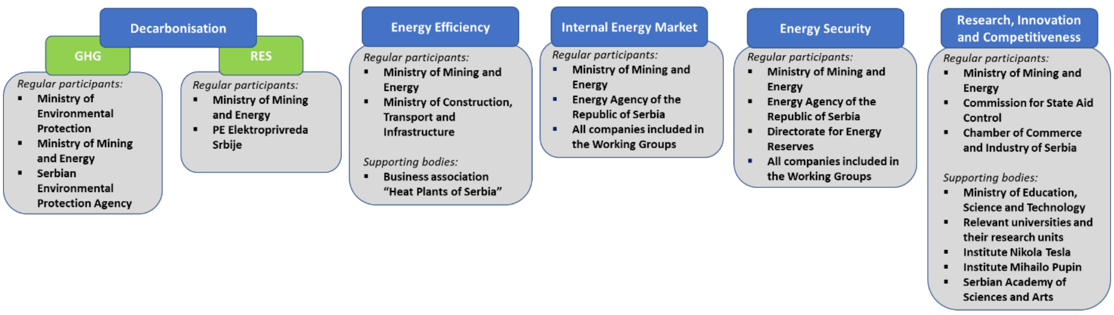

Figure 3.2: Relevant participants by INECP Dimension

Institutions that represent auxiliary bodies in the project, and which are not members of the Working Group, are mainly active in the dimensions of energy efficiency and research, innovation and competitiveness. The Ministry of Mining and Energy initiated the procedure of collecting the opinions of various educational institutions on certain topics, in accordance with their competences and relevance, such as the University of Belgrade, the University of Novi Sad, the University of Niš and the University of Kragujevac. The same procedure applies to the Nikola Tesla Electrotechnical Institute and the Mihailo Pupin Institute, as well as to the Serbian Academy of Sciences and Arts (SANU). In addition, the Business Association "Heating of Serbia" also participates in the meetings related to district heating, while the Belgrade Metro and Railway Company submitted appropriate data and information about the ongoing project and planned activities for the development of railway traffic in Serbia and city of Belgrade. Also, when analyzing the state of energy poverty in the Republic of Serbia and creating the INECP, the study of the non-governmental organization RES Foundation on energy poverty in the Republic of Serbia in 2021 was considered.

Finally, during the preparation of the INECP draft, a series of bilateral and multilateral meetings were held with various stakeholders. Thus, the efforts made resulted in 11 meetings of the Working Group and about 50 bilateral meetings.

The Ministry of Mining and Energy invited, at the beginning of August 2022, all relevant stakeholders to participate in the process of public consultations on the working versions of the INECP scenario for the period up to 2030, with a projection up to 2050. Comments and opinions on the text on Basic information on work scenarios were submitted by the representatives of the institutions within the deadline (September 5, 2022), as shown in Table 3.6.

Table 3.6: Institutions that submitted comments and opinions

	Institutions and individuals
1.	PC “Elektroprivreda Srbije” EPS
2.	TSO “Elektromreža Srbije” EMS
3.	Academy of Engineering Sciences of Serbia
4.	Regulatory Institute for Renewable Energy and Environment (RERI) and Belgrade Open School (BOS)

Comments and opinions were submitted in written form. Some of the comments and suggestions will be included in the final version of the SEA Report. This primarily refers to suggestions in terms of objectives and scenarios of INECP.

In addition to these consultations, extensive consultations will be conducted with interested parties and competent authorities and the public regarding the draft Report on SEA and their opinions will be considered for incorporation into the final document.

3.2.4 Consultations of other Energy Community Contracting Parties and European Union Member States

Since the European Union Member States have finalized and adopted their INECPs until 2021, the Republic of Serbia had an opportunity to access each plan with a special focus on those prepared by the neighbouring countries. First and foremost, the Republic of Serbia assessed the INECPs of countries with common borders, such as Croatia, Bulgaria, Romania and Hungary, primarily regarding the planning activities with cross-border relevance and wider regional impact. At the same time, the Republic of Serbia considered all European INECPs. Moreover, while the Republic of Serbia was drafting its INECP, North Macedonia submitted its draft document to the Energy Community Secretariat, and this enabled the Republic of Serbia to analyse the planning process in this neighbouring country as well. The INECP consultations with the other Energy Community Contracting Parties that are developing and preparing their INECPs in parallel with the Republic of Serbia have been realized through the already existing bodies and mechanisms for regional cooperation, such as:

- Western Balkan 6,

- Central and South-eastern Europe energy connectivity (CESEC),
- Ministerial Council of the Energy Community,
- Energy and Climate Committee,
- Energy and Climate Technical Working Group,
- Renewable Energy Coordination Group,
- Energy Efficiency Coordination Group,
- Security of Supply Coordination Group,
- Coordination Group of Distribution System Operators for Electricity,
- Coordination Group for Cybersecurity and Critical Infrastructure,
- PECI electricity and gas Coordination Groups,
- EnC Permanent High-Level Group and,
- Platforms for Gas and Electricity,
- Energy Community Just Transition Forum,
- Other regular and occasional bilateral and multilateral high-level events

3.2.5 Iterative process with the Energy Community Secretariat

Since the beginning of the development and preparation of the Draft INECP of the Republic of Serbia, the Energy Community Secretariat has been closely following the progress of the overall process, providing the necessary support as needed. Formally, this involvement of the EnC Secretariat is realized through the work of Ministerial Council of the EnC, as well as within the various existing thematic coordination groups, platforms and initiatives at the level of the Energy Community, but also other regional energy-related and climate-related formats where Energy Community actively participates. Once the draft INECP had been completed, the Republic of Serbia has submitted the document to the Energy Community Secretariat for the purpose of consultations and provision of recommendations.

3.3 RELATIONSHIP WITH OTHER RELEVANT PROGRAMMES

► **The Energy Development Strategy of the Republic of Serbia for the period up to 2025 with projections up to 2030 ("Official Gazette of the RS", No. 101/15)**

The Energy Strategy offers a path to market restructuring and technological modernization of the energy sector of the Republic of Serbia. Application of energy efficiency measures, use of renewable energy sources, environmental protection and reduction of the impact on climate change are key elements of the transition towards sustainable development of the energy sector in the Republic of Serbia.

► **Development Plans - The Law on the Spatial Plan of the Republic of Serbia from 2010 to 2020 ("Official Gazette of the RS", No. 88/2010)**

The Law on the Spatial Plan of the Republic of Serbia from 2010 to 2020 sets the basic objective of including climate change as a factor of sustainable development and the environment in sector strategies, as well as the development of a sustainable system of climate change risk management in the Republic of Serbia. Special strategies and programs will be devoted to reducing the impact on climate change due to excessive warming and the release of gases that threaten the ozone layer.

The engagement of alternative renewable energy sources (geothermal energy, solar energy, wind energy, hydro energy) will play a special role in certain areas of the Republic of Serbia where there are favourable conditions for this.

The concept of spatial development of certain areas of the Republic of Serbia will be implemented through two complementary approaches:

- The general concept of development, based on information about observed and expected climate changes and the impacts of climate change on the availability of natural resources (first phase);
- Sectoral concepts that will consider in detail the effects of climate change, both negative and positive, in order to adequately plan spatial development within the sector in question (second phase).

Continuous improvement of knowledge, technologies and strengthening of capacities in the field of climate change in the process of EU integration is expected.

According to the Spatial Plan of the Republic of Serbia from 2010 to 2020 (SPRS), in terms of diversity, energy mineral raw materials, first of all coal, and then oil and gas, have a significant place. The problem is that these resources are used unsustainably, there is no complete analysis of the state and the level of research so far by species, spatial distribution, diversity, volume and quality. There are not enough reserves of medium and high-calorie coal. Reserves in the Kolubara and Kostolac Basins are sufficient for the next 50 years of exploitation (at the current level of exploitation). Excessive reliance on fossil fuels, the disproportion between the geological reserves of coal, oil and natural gas, indicate possible uncertainties in the disposal of those reserves in the future.

According to SPRS, the chances are to recognize climate change as a factor of sustainable development of individual sectors of the economy and overall development, the introduction of EU standards in the field of natural disaster risk management, renewable energy sources, energy efficiency, design and construction of infrastructure systems that are relevant for various aspects of climate change.

The Republic of Serbia has natural advantages for the use of renewable energy sources. According to SPRS 2010 to 2020, biomass energy is the most significant domestic energy potential from renewable sources. Renewable energy sources are used negligibly little, except for water flows in large hydroelectric power plants, because the use of renewable sources is significantly more expensive and is not fully legally regulated. Chances are seen in the possibility of realizing new hydropower systems with HPP facilities on the Drina (middle and lower stream), Lim, Velika Morava, Zapadna Morava, Ibar, Nišava, regulating hydroelectric power plants (HPP Đerdap 1 and 2, HPP Bajina Bašta and RHPP Bajina Bašta), hydropower plants on Uvac and Lim, the Vlasinski system, HPP Pirot - which enable more rational and reliable operation of the EES of the Republic of Serbia, as well as exchange with the surrounding.

► **The Agriculture and Rural Development Strategy of the Republic of Serbia for the Period 2014-2020 ("Official Gazette of the RS", No. 85/2014),**

As a basic long-term strategic document, defines the objectives, priorities and frameworks of political and institutional reform in agriculture and rural development. The Strategy points out that agricultural production has been facing numerous challenges caused by climate change for many years, because agriculture is both an important cause and the sector that suffers the most from the consequences of climate change. Some of the specific objectives defined in the Strategy are sustainable management of resources and environmental protection, which requires new support policies taking into account the multifunctionality of agriculture in order to respond to climate change, protection of agricultural land from permanent change of use, reduction of GHG emissions, protection of biodiversity and typical rural landscapes, rational use of water resources, forests and other natural potentials of rural areas.

► **The Strategy for Cleaner Production in the Republic of Serbia ("Official Gazette of RS", No. 17/09)**

The Strategy elaborates the concept of sustainable development through encouraging cleaner production, increasing the energy and raw materials efficiency and reducing waste generation.

► **The National Strategy for the Sustainable Use of Natural Resources and Goods ("Official Gazette of RS", No. 33/2012)**

The Strategy lacks a comprehensive approach to the area of climate change, given the fact that natural resources are largely exposed to climate change. The strategy defines specific objectives for the sustainable management of water resources and protected natural areas, biodiversity, geodiversity and landscape diversity. It emphasizes the need to conduct a national analysis of vulnerability to climate change and to develop and implement adaptation strategies in the management of protected areas. Based on the analysis of the national shortcomings of the system of protected areas and the analysis of vulnerability to climate change, this Strategy envisages the development of a national plan for the expansion of the system of protected areas.

► **The National Approximation Strategy in the Field of Environment for the Republic of Serbia ("Official Gazette of RS", No. 80/11)**

This Strategy includes, justifies and expands the existing framework for planning the transposition of EU legislation. Through seven accompanying sectoral strategies in environmental protection, one of which is "Air and climate change", guidelines for harmonizing the legislation in the field of environmental protection to the EU legislation, as well as activities related to the improvement of institutional, legislative and financial frameworks, were defined.

3.4 EVALUATION OF ALTERNATIVES

3.4.1 Rationale or Alternative Development

The identification of Alternatives to the Project is a long-standing requirement of the SEA Directive[8] and is often mentioned by practitioners as comprising a difficult element of the SEA process.

Identifying and considering Alternatives can provide a concrete opportunity to adjust the plan or programme's design to minimize adverse environmental effects and, thus, to minimize the Project's significant effects on the environment. Additionally, the proper identification and consideration of Alternatives from the outset can reduce unnecessary delays in the SEA process, or the implementation of the Strategy.

The SEA Directive puts significant weight to the consideration of alternatives. It requires, for applicable plans and programmes, that "*an environmental report shall be prepared in which the likely significant effects on the environment of implementing the plan or programme, and reasonable alternatives taking into account the objectives and the geographical scope of the plan or programme, are identified, described and evaluated*" (Article 5.1).

In addition, as part of the baseline description, it requires a description of "*the relevant aspects of the current state of the environment and the likely evolution thereof without implementation of the plan or programme*" which is essentially the "zero-do nothing" alternative.

Put simply, what is needed is:

- A description of the reasonable Alternatives studied; and
- An indication of the main reasons for selecting the chosen option with regards to the likely significant effects on the environment of implementing the plan or programme.

The number of Alternatives to a proposed plan or programme is, in theory, infinite, considering that the Directive does not specify how many Alternatives should be considered. National legislation or general practice may, however, dictate how many Alternatives are to be considered. The number of alternatives to be assessed has to be considered together with the type of alternatives, i.e., the 'Reasonable Alternatives' referred to in the Directive.

[8] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32001L0042

The European Commission guide on implementing the SEA Directive[9] provides further information on how alternatives should be considered in SEA. Important points include:

- The first consideration in deciding on possible reasonable alternatives should be to the objectives and the geographical scope of the plan or programme.
- Alternatives should be realistic and genuine, and should be, for instance, within the legal competence of the plan-making authority.
- Part of the reason for considering alternatives is to reduce the potential for environmental impacts associated with the proposed plan or programme.
- The impacts of the draft plan and reasonable alternatives must be assessed in a comparable way.

In addition, according to national SEA Law, article 15 refers to alternative solutions as follows:

The assessment of possible impacts of the plan and program on the environment contains the following elements:

1) presentation of the estimated impacts of alternative solutions of the plan and program favourable from the point of view of environmental protection with a description of measures to prevent and limit negative, i.e., increasing positive impacts on the environment;
2) comparison of alternative solutions and presentation of the reasons for choosing the most favourable solution;

In the same Law Appendix II point 4 refers specifically to alternative solutions as following:

1) the manner in which alternative solutions for issues and problems related to the environment were prepared and considered was presented;
2) an alternative solution of non-implementation of the plan and program and the most favourable variant solution from the point of view of environmental protection were prepared;
3) the impacts of alternative solutions on the environment were assessed and a comparison was made;
4) the reasons for choosing the most favourable alternative solution from the point of view of environmental protection are explained.

'Reasonable Alternatives' must be realistic, viable and implementable, and resources should only be spent assessing such reasonable Alternatives.

An Alternative may be considered unreasonable:

- If it is not technically possible and institutionally feasible. It should be noted that alternatives that are politically difficult or objectionable should not necessarily be considered unreasonable.
- If there are legal or regulatory obstacles: alternatives must reflect current legislation requirements and should not conflict with higher-level plan/programme objectives.

[9] https://ec.europa.eu/environment/archives/eia/pdf/030923_sea_guidance.pdf

- If it can't be put into action or operation within the plan/programme timeframe and with the available resources.

Until now, it has been a common practice in Serbia that when considering alternative solutions, the alternative solution of not implementing strategies, programs and plans (business as usual), and the favourable scenario from the aspect of environmental protection with additional measures (WAM), as is presented in the INECP, are considered in the SEA.

3.4.2 Description of Alternatives

3.4.2.1 WEM SCENARIO (BUSINESS AS USUAL)

The existing structure of the energy sector of the Republic of Serbia requires significant changes, arrangements and investments, in order to be harmonized with the European policy in this area. In this sense, the Republic of Serbia plans to set ambitious sustainable goals for reducing GHG emissions, increasing the share of RES, and with regards to the levels of primary and final energy consumption.

The WEM scenario favours a situation which does not meet the fulfilment of the energy and climate change targets (European Green Deal) and does not promote sustainable development. It only includes policies and measures in force until 2020, without any additional interventions.

In particular, it does not favour:

a) **decarbonisation**, where decarbonisation of the economy entails stopping the use of fossil fuels, with an accompanying increased participation of renewable energy sources;
b) **energy security** where security of supply should be based on diversification of sources and on the ability to deliver energy to consumers from different sources, different technologies, different import arrangements, etc. in such a way that the system does not at any moment depend on any homogeneous source or technology, etc. Today most of the existing facilities are about 40 years old, have approximately the same technology and depend more or less on one and the same source, which is lignite;
c) **energy efficiency**, where today Serbia consumes 50% more energy than EU countries. Focusing on energy efficiency, especially for households and the economy, seems imperative (research has shown that 85 % of residential buildings in Serbia do not meet the minimum energy efficiency requirements);
d) **integration of the internal energy market,** where internal markets need to be established in individual countries, then these markets can be integrated into a common one market;

e) **research and innovation** need to be further promoted and continue to be a priority through supporting innovative technologies, which will contribute to the fulfilment of the energy and climate targets.

The "With Existing Measures" (WEM) scenario corresponds to the projection having only the policies in place until 2020, without any additional effort. Therefore:

g) There is no carbon pricing applied in WEM. Electricity generation from lignite fired power plants increases in 2030 by 23% compared to 2019 and continues to be at almost the same level until 2050.

h) The penetration of renewable energy sources is limited, and nuclear power is not considered as an option.

i) Energy efficiency is limited to the rate observed until 2020.

j) There is no introduction of hydrogen in the final energy consumption, and limited introduction of biofuels in transport.

k) Primary energy consumption in 2030 reaches 17,528ktoe and the final energy consumption reaches 10,909 ktoe.

l) The penetration of EVs is limited without any extra measure for their promotion.

The most important projections relevant to this scenario are presented in the table below.

Table 3.7: WEM key projections

THE RESULT	Base year 2020	WEM Projection for 2030
GHG Emissions in $ktCO_2$ eq (to be compared to 1,990 when 80,094 $ktCO_2$ eq)	56,163	64,577
Reduction of GHG emissions in % compared to 1990	29.9%	19.3%
Share of renewable energy sources in gross final energy consumption in %	26.3%	27.6%
Share of RES in electricity production, %	29%	29%
- consumption of primary energy Mtoe	15,083	17,600
- consumption of final energy Mtoe	8,887	10,615
Import dependence, total energy, %	32%	35%
Import dependence, electricity, %	-0.5%	-4.4%
Electricity production in GWh	37,615	45,892
Installed capacities for electricity production in MW, of which:	8,660	9,777
- RES capacities (including hydro) in MW	2,893	3,698

THE RESULT	Base year 2020	WEM Projection for 2030
- Reversible HE(additional 680 MW will be in operation in 2031)	614	614
- CCGT Power Plant in MW	/	/
Overall Planned Public Aid Investment needs until 2030 in INECP	/	5.69 billions €
Change of unemployment with respect to WEM in 2030 (%)	/	/
Change in GDP with respect to WEM in 2030 (%)	/	/

Table 3.8: WEM key results

YEAR/ACTIVITY	2023	2024	2025	2026	2027	2028	2029	2030
NEW CAPACITY LIGNITE FIRED	350							
MODERNISATION OF THE MINING INDUSTRY							✓	
NEW SOLAR PLANTS POWER PLANTS (MW)	9.9	275			80			

The WEM scenario is expected to have impacts on the following environmental areas:

Climate change and ambient air

The WEM scenario which entails full use of lignite fired plants and limited penetration of RES for energy production and in transport and gasification of settlements will have strong negative cumulative effects by increasing amounts of CO2 emissions. It is estimated that every million BTUs released from burning coal releases an average of 94,347 kg of CO2. Since a ton of coal has 20.025 million BTUs, that means it creates 1892,387 kg of CO2 when it is burned.

When it comes to ambient air, negative cumulative effects can occur regarding the quality of ambient air as lignite fired plants produce several principal emissions (sulfur dioxide contributing to acid rain, nitrogen oxides contributing to smog, particulate matter contributing to smog and haze, mercury which is a highly toxic substance). Further, storage of fly ash in open piles can result in increasing air pollutant emissions (fly ash can contain silica and other toxic metals cadmium, copper, chromium, nickel, lead, mercury, titanium, arsenic, and selenium).

In addition, in existing coal mines, as well as possibly newly opened mines, the cumulative impacts of fugitive dust emissions can dominate in the coal exploitation and preparation. During mining, dust concentrations may exceed the ambient air quality limit values in the vicinity of surface mines and nearby settlements.

INECP foresees a considerable penetration of electric vehicles with the aim to achieve this penetration at the most cost-effective approach for the national economy, while ensuring that certain prerequisites for the electrification of the transport sector, such as the simultaneous development of the charging infrastructure and the adoption of the regulatory framework are timely fulfilled. This is not the case for the WEM scenario, where the ambient air quality in urban areas and settlements is expected to be aggravated.

As the area of Serbia may have other sources of particle emission (industrial plants, households and traffic), the cumulative effect on parts of the area may exceed the limit values of ambient air quality in unfavourable weather conditions.

Water

The use of existing coal mines or the opening of new ones has harmful cumulative impacts on surface and ground water in the vicinity of surface mines and nearby settlements. The disposal of liquid coal waste in landfills can lead to groundwater contamination.

Land

The use of existing mines as well as the existing facilities of lignite fired plants which are about 40 years old and have approximately the same technology will lead to the pollution of soil (pollutants may be heavy metals such as As, Pb, Cu, Zn, Mn, and Cd).

Further use of existing coal mines and in the case of the construction of new mines, it will have a cumulative negative impact on the occupation of agricultural land.

Biodiversity

Due to the operation of fossil fuel power plants, impacts on biodiversity are indirectly manifested through emissions of pollutants (NOx, SO2, SO and CO2 and particulates) into the air. In addition, coal mining, installation of pipelines, and construction of roads leading to the mining site causes direct damage to natural ecosystems such as destruction of forests and other landscapes that make them unfit for sustaining wildlife populations.

Waste

The amount and type of wastes from a power plant depend on the type of power plant and the fuel used. Wastes from power plants include sludge, ash and other types of waste. However, consistent application of EU legislation can have a cumulative positive impact in the field of waste management.

Population and human health

Lignite is the most health-harming form of coal, given the higher amount of pollution resulting from its combustion. The health effects related to the operation of coal power plants mostly stems from the release of harmful air pollutants, which contribute to poor air quality, impacting heart and lung health in particular (NOx contributing to respiratory illness, particulates contributing to respiratory illnesses and lung disease). These health impacts are not only felt in the proximity of the plants but because of the transboundary nature of pollution, coal power generation can lead to health impacts or costs far away from the source of combustion.

Transboundary influence

As a signatory to the ESPOO Convention and Kiev Protocol, the Republic of Serbia has bound itself to inform other countries about proposed projects which may have transboundary impacts.

The Republic of Serbia cooperates with the countries in the region on issues of water quality control and transboundary water pollution. International cooperation primarily refers to water quality of the Danube, Sava, Tisa, Tamiš and Drina rivers.

3.4.2.2 WAM SCENARIO (WITH ADDITIONAL MEASURES)

INECP 2030 has as its compass the "sustainable development of Serbian energy sector in a way that is beneficial to the economy, society and the environment" for the next decade. It defines strategic priorities for the energy sector development in the Republic of Serbia which are established within the Plan. Particularly, the main pillars of the INECP comprise an increased penetration of RES in Serbia's energy mix along with targeted energy efficiency measures aiming to reduce the final energy consumption by increasing energy performance. This clean energy transition pathway tends to enhance the country's energy security, safeguards its energy dependency while ensuring a realistic reduction of lignite use, contributing to a meaningful reduction of the GHG emissions by 2030. The proposed measures, activities and projects are aimed at overall transition to a sustainable energy sector in Serbia. The proposed categories of interventions in the INECP are expected to act positively in terms of sustainable development as they incorporate the dimension of a development approach that is expected to be implemented with due care for the protection of the environment and the preservation of resources, so that the sustainability and development of future generations is not jeopardized, including economic, social and environmental aspects which are mutually reinforcing.

INECP constitutes an integrated and continual planning approach by seeking sustainable measures through integrating realistic objectives with potentials in the energy sector on the one hand, and the need for protecting the environment, quality of life of people and socio-economic development, on the other.

The scenario S (WAM) with additional measures has two options:

- Scenario S without nuclear energy;
- SN scenario with nuclear energy.

The specifics include:

- A moderate process of decarbonisation until 2030, i.e., a reduction in electricity production from lignite fired thermal power plants until 2030 (25 % compared to 2019). However, it is expected some necessary modernization of mining sector in order to safeguard the operation of the existing lignite power plants.
- By 2050, lignite fired thermal power plants will completely stop producing electricity in both variants of this scenario, it is foreseen that, in the entire period, part of the coal-fired thermal power plants that will not be in operation can be used as a reserve, with a capacity of 1,427 MW in the year 2050, in the variant without nuclear energy and

745 MW in the variant with nuclear energy.

- In the scenario with nuclear energy, nuclear power plants are introduced into the power system after 2040 with a capacity of 1000MW.
- In both scenarios, the total consumption of primary energy is 14,689 ktoe, and the consumption of final energy is 9,670 ktoe in 2030. This is very important from the aspect of energy efficiency because the implementation of energy efficiency measures is evaluated according to the consumption of primary and final energy, which must not exceed the values obtained in these scenarios.

Input data related to the building renovation rate, the participation of heat pumps and solar water heaters, the share of biofuels in traffic and electric vehicles as well as RES in district heating are the same in both S scenarios.

The most important results of this scenario are presented in the table below.

Table 3.9: WAM key projections

THE RESULT	Base year 2020	Scenario-S Projection for 2030
GHG Emissions in ktCO$_2$ eq (to be compared to 1,990 when 80,094 ktCO$_2$ eq)	56,163	47,765
Reduction of GHG emissions in % compared to 1990	29.9%	40.3%
Share of renewable energy sources in gross final energy consumption in %	26.3%	33.6%
Share of RES in electricity production, %	29%	45%
- consumption of primary energy Mtoe	15,083	14,689
- consumption of final energy Mtoe	8,887	9,670
Import dependence, total energy, %	32%	41%
Import dependence, electricity, %	-0.5%	-1.6%
Electricity production in GWh	37,615	40,185
Installed capacities for electricity production in MW, of which:	8,660	11,216
- RES capacities (including hydro) in MW	2,893	6,217
- Reversible HE(additional 680 MW will be in operation in 2031)	614	614
- CCGT Power Plant in MW	/	350
Overall Planned Public Aid Investment needs until 2030 in INECP	/	10.04 billion€
Change of unemployment with respect to WEM in 2030 (%)	/	+0.2%
Change in GDP with respect to WEM in 2030 (%)	/	+1.5%

Table 3.10: WAM key results

YEAR/ACTIVITY	2023	2024	2025	2026	2027	2028	2029	2030
NEW CAPACITY TE KOSTOLAC B3 (MW)	350							
NEW WIND POWER PLANTS (MW)			150.00	150.00	162.50	175.00	187.50	200.00
NEW SOLAR PLANTS POWER PLANTS (MW)	32.55	230.00	233.33	236.67	240.00	243.33	246.67	250.00
NEW REVERSIBLE HE (MW)								
PRODUCTION HYDROGEN								
Interconnector Serbia - Bulgaria	✓							
Interconnector Serbia - North Macedonia		✓						
Interconnector Serbia - Romania		✓						
Interconnector Serbia - Bosnia and Herzegovina		✓						
Interconnector Serbia - Croatia					✓			
Interconnector Serbia-Montenegro		✓						
Interconnector Serbia- Hungary								✓
Interconnector Serbia-Montenegro- Bosnia and Herzegovina								✓

The WAM scenario is expected to have an impact on the following environmental areas:

Climate change and ambient air

According to the WAM scenario, positive cumulative effects can occur through the reduction of CO2 emissions linked to not planning the opening of new coal mines, using natural gas as a substitute for coal, intensive use of RES for energy production and in transport and gasification of settlements.

When it comes to ambient air, positive cumulative effects can occur by preventing the use of coal for the production of electricity and heat, using natural gas as a substitute for coal, intensive use of RES for the production of electricity and heat and in transport and gasification of settlements.

In existing coal mines, as well as possibly newly opened mines, the cumulative impacts of fugitive dust emissions can dominate in the coal exploitation and preparation. During mining, dust concentrations may exceed the ambient air quality limit values in the vicinity of surface mines and nearby settlements.

As the area of Serbia may have other sources of particle emission (industrial plants, households and traffic), the cumulative effect on parts of the area may exceed the limit values of ambient air quality in unfavourable weather conditions.

Water

In the absence of the opening of new coal mines, the impact on ground and surface water will be cumulatively reduced.

Further reuse of existing coal mines and in the case of new mines may have harmful cumulative impacts on surface and ground waters in the vicinity of surface mines and nearby settlements. Negative cumulative impacts are possible in cases of water potential exploitation in MHPP if several hydropower plants are built on the same watercourse.

Land

The application of the latest technologies in thermal power plants and the intensive introduction of the use of RES will lead to a reduction in soil pollution due to a reduction in the emission of pollutants in the soil. It is noted that according to Article 2, paragraph 1) of the Regulation on the conditions, manner and procedure for granting agricultural land in state ownership for use for non-agricultural purposes ("Official Gazette of RS" No. 69/2021), which regulates that state land can be granted for use in the production of renewable energy sources (wind power plant and solar power plant). In addition, the impacts on land from the construction & operation of solar power plants will need to be examined analytically when conducting the EIA for each solar power plant.

Biodiversity

Birds and bats are suffering from wind farms. Hydropower plants are under the influence of large areas that are occupied by the formation of storage lakes, they affect the landscape along the riverbeds, small storage hydropower plants provide the necessary biological minimum flow of water and, by building fish paths, reduce the negative impact on ichthyofauna, and the small storage mini-hydropower plants have an extremely negative impact on river ecosystems, flora and fauna.

The construction of solar panels can require significant areas of land, which can lead to the conversion of natural habitats. This leads to the loss and fragmentation of natural ecosystems and habitats for plant and animal species. Large solar power plants can create obstacles for animal movement, especially if they are located on migration corridors. This can limit animals' access to food, water and suitable habitats, as well as make it difficult to find mating partners, which leads to a decrease in abundance and genetic isolation of populations. Solar panels can influence the change of microclimatic conditions in the environment, especially under the panels themselves. Placing a large number of panels can lead to disturbance of the light, temperature and water regimes of the habitat. Changes in microclimatic conditions under the panels can adversely affect sensitive plant and animal species. The danger to biodiversity from solar parks can be particularly pronounced if their construction is planned near the habitats of endemic and endangered species.

Waste

The amount of waste from lignite power plants will be decreased as the RES penetration will increase for energy production and in gasification of settlements. However, consistent application of EU legislation will have a cumulative positive impact in the field of waste management.

Population and human health

Implementation of WAM will result in the emission of polluting substances into the environment to be reduced, and thus a cumulative positive impact on human health will be achieved.

Further reuse of existing coal mines and in the case of the opening of new mines and the operation of coal-fired thermal power plants may have a cumulative negative impact on the population.

Socio-economic development

Realization of INECP's objectives will lead to a positive cumulative impact on the elements of socio-economic development (economic growth, raising the standard of living, employment, etc.). Particularly, until 2030, Scenario S (WAM) leads to a continuous increase of the GDP with respect to WEM. Then, the positive change becomes more aggressive by 2045 (slightly oscillating between +1.7% and +2.2%) and presents a negligible descent between 2045 and 2050. However, the change is always greater than +1.2%, with respect to the WEM scenario, through the whole-time horizon. This means that the policy and technology options included in the WAM scenario have a positive impact on the economy leading to higher GDP growth rates compared to the WEM scenario.

Transboundary influence

The possibility and potential for cross-border impact from the implementation of the planning document varies depending on the measures/actions considered in the INECP. Given that consideration and analysis of opportunities for energy development is carried out at a strategic level, at that moment it is difficult to identify the cross-border impact and its details. From what is considered, generally transboundary impacts can be associated with the following types of projects:

- large hydropower plants,
- smaller hydropower facilities in border regions,
- wind farms in border regions,
- cross-border infrastructure of natural gas in order to diversify supply routes,
- improvements (new investments and revitalization) in the electricity transmission system network.

In accordance with the relevant legislation, the energy sector will, at the level of specific projects, with clearly defined deadlines for implementation, assess in detail the possible impacts on the environment and potential cross-border impacts, prescribe binding environmental protection measures and appropriate monitoring. Transboundary impacts should be considered individually and in detail at the project level, that is, in the EIA procedures.

3.4.3 Evaluation of WEM and WAM scenario

The actions proposed as part of the proposed INECP, are presented in detail in Section 3.1.3. of the present study and will serve the achievement of the set goals of the INECP as outlined in Section 3.1.1. The detailed evaluation of the likely effect of these actions on the environment is presented in Section 5.1 of the present document. An overview of policy measures for both scenarios is presented in the below Table.

Table 3.11: Overview of policy measures of WEM and WAM scenario

PAM no.:	Policy or measure name (R/I)	Implementation Cost (million €)	Scenario WEM	Scenario WAM
Decarbonization				
PM_D1:	Preparation for and Introduction of carbon tax	0,20	WEM	
PM_D2:	Adoption, Implementation and monitoring of the Low-carbon Development Strategy and Action Plan for its implementation and developing an Adaptation Plan to Climate Change	1,4	WEM	
PM_D3:	Promoting circular economy	4,5	WEM	
PM_D4:	Organising awareness campaigns for better information dissemination (I)	3,00	WEM	
PM_D5:	Establishment & operation of the National Climate Change Council, Carbon Footprint Observatory for all sectors & National GHG inventory system	0,5	WEM	
PM_D6:	Implementation and monitoring of Just Transition and related Action Plan	2	WEM	
PM_D5:	Implementing technological changes in production processes in specific industries	29	WEM	
PM_D6:	Emission reduction measures in the refrigeration and air conditioning - fluorinated gas emissions	16	WEM	
PM_D14:	Improvement of wastewater treatment and discharge (	90	WEM	
PM_D15:	Improvement of waste management practices including a decrease of biodegradable components of waste disposed of to landfills and increased recycling	80	WEM	
PM_D16:	Higher percentage of municipal solid waste treated by biological options	85	WEM	
PM_D17:	Utilisation of the entire CH_4 generated from all dumped quantities of waste that end up to sanitary landfills	48	WEM	
PM_D18:	Promotion of composting in both centralised & household perspectives	60	WEM	
PM_D7	Sustainable forest management (forest land remaining forest land)	354	WEM	
PM_D8:	Land conversion to cropland	8,5	WEM	
PM_D9:	Increase the tree-planted areas (groves/parks/green roofs)	6,5	WEM	

PAM no.:	Policy or measure name (R/I)	Implementation Cost (million €)	Scenario WEM	Scenario WAM
PM_D10:	Measures for the reduction of CH_4 emissions measures from the enteric fermentation of animals	0,5	WEM	
PM_D11:	Improvement of manure management for the reduction of CH_4 & N_2O emissions	9	WEM	
PM_D12:	Measures for the reduction of direct & indirect N_2O emissions from managed soils (I)	6	WEM	
PM_D13:	Measures for reducing emissions from fertilizers use	28	WEM	
PM_D19:	Support scheme based on tendering procedures (auction scheme) for commercially cost-effective RES technologies - rephrase	2100	WEM	WAM
PM_D20:	Application of the legislative framework for the participation of the RES producers in electricity market	0,2	WEM	WAM
PM_D21:	Support RES technologies that will not participate into the tendering procedures	700	WEM	WAM
PM_D22:	Provision of economic support to innovative and demonstration pilot RES projects			WAM
PM_D23:	Fostering the further utilization of guarantees of origin for energy from RES	0,1	WEM	
PM_D24:	Updating simplifying and optimising the authorisation, certification permit granting and licensing procedures - establishment of one stop shop	0,20		WAM
PM_D25:	Updating, simplifying and optimising the spatial planning framework	0,10		WAM
PM_D26:	Updating, simplifying and optimizing the grid connection procedures and setting detailed methodology and allocation rules for RES grid connection costs	0,10		WAM
PM_D27:	Fostering the self-consumption of the produced electricity			WAM
PM_D28:	Establishing public accessible registry for RES electricity producers	0,5	WEM	WAM
PM_D29:	Adaptation, enhancement and expansion of the grid networks for avoiding congestions and enabling the optimal penetration of RES	Under examination	WAM	
PM_D30:	Promotion of RES for heating and cooling in new and renovated buildings			WAM
PM_D31:	Provision of fiscal and economic incentives to foster RES in heating and cooling			WAM
PM_D32:	Facilitating the penetration of RES into district heating networks	8,00		WAM
PM_D33:	Fostering the production of biofuels in transport sector	30,00		WAM
PM_D34:	Fostering the consumption of biofuels in transport sector	0,50		WAM
PM_D35:	Development of the required infrastructure for recharging electric vehicles			WAM
PM_D36	Provision of fiscal and economic incentives to foster the further deployment of electric vehicles		WEM	WAM
PM_D37:	Promotion of renewable energy communities			WAM
PM_D38:	Development of the legislative framework and provision of incentives for the promotion of energy storage technologies	1,00		WAM
PM_D39:	Supporting demonstration projects for the promotion of biomethane and renewable hydrogen	35,00		WAM

PAM no.:	Policy or measure name (R/I)	Implementation Cost (million €)	Scenario WEM	Scenario WAM
PM_D40:	Development of the required legislative framework and the required infrastructure for the deployment of biomethane and renewable hydrogen	0,80		WAM
PM_D41:	Development of effective supply chains for the exploitation of the available potential of biofuels, bioliquids and biomass			WAM
PM_D42:	Specification of the sustainability and GHG emissions saving criteria for biofuels, bioliquids and biomass fuels including the required monitoring and verification activities	0,20	WEM	WAM
PM_D43:	Conduction of information and training activities to all to all relevant actors for the use of RES including the development of a certification scheme for RES professionals	0,20		WAM
PM_D44:	Promotion of RES through green public procurements		WEM	
Energy Efficiency				
PM_EE1:	Financing and fiscal measures for the renovation of residential buildings	1310,52	WEM	WAM
PM_EE2:	Financing and fiscal measures for the renovation of public buildings	55,03	WEM	WAM
PM_EE3:	Financing and fiscal measures for the renovation of non-residential buildings (not public)	2017,11	WEM	WAM
PM_EE4:	Completion of legislative framework in alignment with Directive 2018/844/EU and regulatory measures to promote near-zero energy buildings (nZEBs)		WEM	
PM_EE5:	Programs for the renovation of buildings exceeding minimum energy requirements (nZEBs)			WAM
PM_EE6:	Mandatory installation of solar thermal systems in new buildings and in buildings undergoing major renovation	636,74		WAM
PM_EE7:	Enhancing the role of the energy performance certificates		WEM	
PM_EE8:	Overcoming split incentive barrier			WAM
PM_EE9:	Promotion of energy efficient, lighting systems, electric appliances and office equipment	1493,81	WEM	WAM
PM_EE10:	Promotion of energy efficient passenger and light-heavy duty vehicles	1713,00	WEM	
PM_EE11:	Ensuring the energy efficiency in imported used passenger cars		WEM	
PM_EE12:	Financing programs for the promotion of energy efficiency passenger vehicles	570,23		WAM
PM_EE13:	Development of the required infrastructure for the promotion of alternative fuels			WAM
PM_EE14:	Promotion of energy efficiency of the freight transport	1596,00	WEM	WAM
PM_EE15:	Promotion of modal shift both for passenger and freight transport -Enabling 'Mobility as a Service' (MaaS)		WEM	
PM_EE16:	Promotion of energy efficiency in inland waterways transport	0,00	WEM	
PM_EE17:	Promotion of energy efficiency in rail transport	255,77	WEM	
PM_EE18:	Continuous enhancement and extension of the relative infrastructure for public transport	505,39	WEM	

PAM no.:	Policy or measure name (R/I)	Implementation Cost (million €)	Scenario WEM	Scenario WAM
PM_EE19:	Development of sustainable regional or municipal mobility plans			WAM
PM_EE20:	Supplementary actions for the promotion of energy efficiency in transport sector		WEM	
PM_EE21:	Support schemes for the promotion of energy efficiency in industrial sector	4366,00	WEM	WAM
PM_EE22:	Regulatory measures for the promotion of energy efficiency in industrial sector		WEM	WAM
PM_EE23:	Supplementary actions for the promotion of energy efficiency in industrial sector			WAM
PM_EE24:	Support schemes for the promotion of energy efficiency in agricultural sector	2678,00		WAM
PM_EE25:	Advisory services and energy audits for farmers			WAM
PM_EE26:	Promotion of energy services and energy performance contracts through targeted financing programs			WAM
PM_EE27:	Promotion of energy services and energy performance contracts through supplementary activities			WAM
PM_EE28:	Mandatory conduction of energy audits and development of energy management systems		WEM	
PM_EE29:	Promotion of energy audits in SMEs and in households			WAM
PM_EE30:	Financing programs for the energy upgrading of street lighting	1668,81	WEM	
PM_EE31:	Conduction of awareness raising activities		WEM	
PM_EE32:	Promotion of energy-efficient products through the implementation of energy labelling and eco-design Directives		WEM	
PM_EE33:	Promotion of green public procurements		WEM	
PM_EE34:	Regulatory measures and financing programs for promoting/modernizing high efficient CHP units and district heating/cooling networks	35,00	WEM	
PM_EE35:	Development of a scheme for the qualification, accreditation and certification of energy efficiency professionals			WAM
PM_EE36:	Promotion of energy efficiency in water supply, distribution and consumption	Under examination		WAM
PM_EE37:	Strengthening the technical and administrative capacity of the involved policy makers		WEM	
PM_EE38:	Development of sustainable and innovative financing of energy efficiency projects		WEM	
PM_EE39:	Improve the bankability of energy efficiency projects			WAM
PM_EE40:	Deployment of smart meters (synergies with energy market dimension)			WAM
PM_EE41:	Promotion of smart and carbon neutral cities			WAM
PM_EE42:	Promotion of measures for improving energy efficiency in electricity infrastructure		WEM	WAM
PM_EE43:	Promotion of measures for improving energy efficiency in natural gas infrastructure		WEM	WAM
PM_EE44:	Promotion of demand response and dynamic pricing and tariffs			WAM
Energy Security				
PM_ES1:	Gas interconnector Serbia Bulgaria (MG10)	82,95	WEM	
PM_ES2:	Enhancement of regional electricity and gas interconnection	182,70	WEM	

PAM no.:	Policy or measure name (R/I)	Implementation Cost (million €)	Scenario WEM	Scenario WAM
PM_ES3:	Building capacities for energy storage	1	WEM	
PM_ES3.1:	Banatski dvor, natural gas storage	100	WEM	
PM_ES3.2:	Creating mandatory reserves of oil and petroleum products	0,5	WEM	
PM_ES4:	Creating operational reserves of oil, coal & other energy derivatives	0,5	WEM	
PM_ES5:	Creating mandatory natural gas reserves	0,5	WEM	
PM_ES6:	Electricity Risk Preparedness plan	0,5	WEM	
PM_ES7:	Security of supply regulation update	0,1	WEM	
PM_ES8:	Oil product pipeline (Pančevo refinery - Novi Sad, Sombor, Belgrade, Niš, via Smederevo, Jagodina	400	WEM	
PM_ES9	Development of a pumped storage project in Bistrica	835,00	WEM	
PM_ES10	Development of additional dispatchable generation from natural gas	300,00	WEM	
PM_ES11	Modernisation of the coal mining industry	1300,00	WEM	
Internal Energy Market				
PM_IEM1:	Implementation of Transbalkan Corridor: OHL SS Kragujevac (RS) - Kraljevo(RS)	26,9	WEM	
PM_IEM2:	Implementation of Transbalkan Corridor: OHL Obrenovac (RS) - Bajina Basta (RS)	89,68	WEM	
PM_IEM3:	Implementation of Transbalkan Corridor: OHL B.Basta(RS) - Visegrad(BA) - Pljevlja (ME) (I)	52,32	WEM	
PM_IEM4:	Interconnection between Resita (RO) & Pancevo (RS) (PCI 3.22.1)	0,00	WEM	
PM_IEM5:	Pannonian corridor	108,00	WEM	
PM_IEM6:	Central Balkan Corridor	214,07	WEM	
PM_IEM7:	RES integration cluster of projects - North CSE Corridor (I)	200,00	WEM	
PM_IEM8:	Regional gas connection through the implementation of interconnection projects	224	WEM	
PM_IEM8.1:	Implementation of the Serbia-Bulgaria gas interconnection project	85,5	WEM	
PM_IEM8.2:	Project for Serbia-Romania gas interconnection 85.5 km (out of which 12.8 km is on the territory of the Republic of Serbia), with a capacity of 1.2 billion m3/year	16	WEM	
PM_IEM8.3:	Project for Serbia-Croatia gas interconnection (95 km, with a capacity of 1.5 billion m3/year)	144	WEM	
PM_IEM8.4:	Project for Serbia-BiH gas interconnection 90 km with capacity of 1.2 billion m3/year	47	WEM	
PM_IEM8.5:	Main gas pipeline RG 11-02 Leskovac-Vladičin Han-Vranje	50	WEM	
PM_IEM8.6:	Gas pipeline - interconnection with Montenegro	60	WEM	
PM_IEM8.7:	Project for Serbia-Macedonia gas interconnection 70.7 km with a capacity of 0.8 billion m3/tear	20	WEM	
PM_IEM8.8:	Project for Niš-Priština gas pipeline construction65 km with a capacity of 0.8 billion m3/year	30	WEM	
PM_IEM9:	Investments related to the digitalisation of the networks aiming at increasing RES integration & improvement of quality of supply	10	WEM	
PM_IEM10:	Cluster of network infrastructure projects - Belgrade wider area (BEOGRID)	65,6	WEM	

PAM no.:	Policy or measure name (R/I)	Implementation Cost (million €)	Scenario WEM	Scenario WAM
PM_IEM11:	Smart meters roll out in electricity DSO	32,2	WEM	
PM_IEM12:	Studies for gas in smart meters roll out in natural gas distribution	1	WEM	
PM_IEM13:	Design and implement market and network data management model	0,4	WEM	
PM_IEM14:	Promotion of demand response for end-users by use of the dynamic tariff system	0,2	WEM	
PM_IEM15:	Equipping gas distribution with metering & data collection devices (measuring equipment, measuring and operational platform, SCADA) necessary for the functioning and development of the gas market	3-5	WEM	
PM_IEM16:	Appointment of the Nominated Electricity Market Operator (Article 183a in accordance to the amendments of the Energy Law)	0,2	WEM	
PM_IEM17:	Development of the regulatory framework for the operation of the “producer-consumer” (prosumer) (Article 169 in accordance to the amendments of the Energy Law and Article 58 to 61 of the Law on the use of RES)	0,2	WEM	
PM_IEM18:	Development of the regulatory framework for the operation of the “electricity storage” (Article 169 in accordance to the amendments of the Energy Law)	0,2	WEM	
PM_IEM19:	Development of the regulatory framework for the operation of the “aggregator” (Article 169 in accordance to the amendments of the Energy Law)	0,2	WEM	
PM_IEM20:	Development of the regulatory framework for the operation of the Renewable Energy Communities (RECs) and Citizen Energy Communities (CECs) (Article 62 to 66 and Article 77 of the Law on the use of RES)	0,2	WEM	
PM_IEM21:	Implementation of EU Network Codes and Guidelines on electricity through appropriate amendments of the secondary legislation and adoption of additional rules, decisions and acts, where applicable.	0,2	WEM	
PM_IEM22:	Unbundling and Certification of Transmission System Operators	0,2	WEM	
PM_IEM23:	Implementation of Regulation (EU) 2017/459	0,2	WEM	
PM_IEM24:	Implementation of Regulation (EU) 2017/460	0,2	WEM	
PM_IEM25:	Implementation of Regulation (EU) 2014/312	0,2	WEM	
PM_IEM26:	Reform of the Wholesale market to foster competition (R)	0,2	WEM	
PM_IEM27:	Further development of Retail market opening (R)	0,2	WEM	
PM_IEM28:	Upgrade of Grid Code update of Srbijagas & development of grid code for Yugorosgaz Transport	0,2	WEM	
PM_IEM29:	Intensify gasification efforts at the exit points of GASTRANS	0,2	WEM	
PM_IEM30:	Development of regulatory framework for biomethane	0,2		
PM_IEM31:	Market coupling to the Single Day Ahead Market (SDAMC)	0,2	WEM	
PM_IEM32:	Market coupling to the Single Intra Day Market (SIDC)	0,2	WEM	

PAM no.:	Policy or measure name (R/I)	Implementation Cost (million €)	Scenario WEM	Scenario WAM
PM_IEM33:	Preparation & adoption of action plan to ensure energy poverty reduction	0,2	WEM	
PM_IEM34:	Regulatory measures for energy poor households, provision of allowances for short-term alleviation of energy poverty (i.e. energy card or social tariff)	Under examination		WAM
PM_IEM35:	Preparation of special programs for application of EE measures and promotion of RES among vulnerable customers for the long-term confrontation of energy poverty			WAM
PM_IEM36:	Facilitate access to alternative energy sources to reduce energy poverty	0,2		WAM
PM_IEM37:	Improvement of tools & methodology for data collection relevant to energy poverty monitoring	1,5		WAM
PM_IEM38:	Awareness & information measures for energy poverty	0,7		WAM
Research, Innovation and Competitiveness				
PM_RIC1:	Enhancement of the legal framework to encourage Research and Innovation	0,1	WEM	
PM_RIC2:	Establishment of a Joint State Aid Action on Research and Innovation in the field of Energy	2,7	WEM	
PM_RIC3:	Establishment of a Multiannual Investment Plan for the strengthening of R&I infrastructures	0,1	WEM	
PM_RIC4:	Integration of Serbia into the European Research Area and enhanced participation in EU's funded Energy R&I Programs	0,1	WEM	
PM_RIC5:	Development of Innovation Hubs / Clusters, Start-ups, Spin-offs/Spin-outs	5,4	WEM	
PM_RIC6:	Development of specialised Competence Centers	3,6	WEM	
PM_RIC7:	Facilitation of the establishment of regional centres of research excellence	3,4	WEM	
PM_RIC8:	Establishment and networking of Technology Transfer Offices of research organisations / institutes and Science Technology Parks	15,3	WEM	
PM_RIC9:	Support the cooperation between research institutes and businesses in the technology transfer and exploitation of research results	3,2	WEM	
PM_RIC10:	Development of innovative energy-saving technologies	7,2	WEM	
PM_RIC11:	Development of innovative decarbonisation technologies, with emphasis on RES for electricity, heating/cooling production, hydrogen production, carbon capture, storage and utilisation (CCU-CCS) technologies	25,2	WEM	
PM_RIC12:	Research on the digitization of energy networks and the development of smart grids	9,0	WEM	
PM_RIC13:	Development of innovative technologies in transport and applications for micro-mobility	10,9	WEM	
PM_RIC14:	Development of innovative energy storage applications	9,0	WEM	
PM_RIC15:	Promote the inter-sectoral and geographical mobility of researchers	1,6	WEM	
PM_RIC16:	Enhancing education / training to support the energy transition	2,2	WEM	
PM_RIC17:	Promotion of entrepreneurship through research and innovation actions which are embedded in market functions	1,8	WEM	

PAM no.:	Policy or measure name (R/I)	Implementation Cost (million €)	Scenario WEM	Scenario WAM
PM_RIC18:	Optimising support framework and schemes for promoting investments with a view to strengthening competitiveness	0,1	WEM	
PM_RIC19:	Strengthening competitiveness through the establishment and operation of Special Target Funds	0,1	WEM	
PM_RIC20:	Promoting innovative circular economy technologies to improve businesses competitiveness	4,5	WEM	

In addition, the Table below presents a comparison of the expected results of WEM and WAM scenarios:

Table 3.12: WEM / WAM comparative key projections

THE RESULT	Base year 2020	WEM Projection for 2030	Scenario-S Projection for 2030
GHG Emissions in ktCO$_2$ eq (to be compared to 1,990 when 80,094 ktCO$_2$ eq)	56,163	64,577	47,765
Reduction of GHG emissions in % compared to 1990	29.9%	19.3%	40.3%
Share of renewable energy sources in gross final energy consumption in %	26.3%	27.6%	33.6%
Share of RES in electricity production, %	29%	29%	45%
- consumption of primary energy Mtoe	15,083	17,600	14,689
- consumption of final energy Mtoe	8,887	10,615	9,670
Import dependence, total energy, %	32%	35%	41%
Import dependence, electricity, %	-0.5%	-4.4%	-1.6%
Electricity production in GWh	37,615	45,892	40,185
Installed capacities for electricity production in MW, of which:	8,660	9,777	11,216
- RES capacities (including hydro) in MW	2,893	3,698	6,217
- Reversible HE(additional 680 MW will be in operation in 2031)	614	614	614
- CCGT Power Plant in MW	/	/	350
Overall Planned Public Aid Investment needs until 2030 in INECP	/	5.69 billions €	10.04 billion€
Change of unemployment with respect to WEM in 2030 (%)	/	/	+0.2%
Change in GDP with respect to WEM in 2030 (%)	/	/	+1.5%

Based on the above table of key figures, it becomes obvious the scenario WAM offers the most environmental and socio-economic advantages (GHG Emissions in ktCO2 eq which is 47.76, Reduction of GHG emissions in % compared to 1990 which is 40.3% and reduction of GHG without sink is 33.3% compared to 1990, the Change of unemployment with respect to WEM in 2030 (%) which is +0.2%, the Change in GDP with respect to WEM in 2030 (%) which is +1.5%).

Concluding, the implementation of WAM scenario is expected to contribute to high rates of economic growth, the creation of new jobs and most importantly a balance between the development of the energy sector and environmental protection, as a key requirement of the Green Agenda, whereas by having WEM the problems currently facing the energy sector are expected to be perpetuated.

From the comparison of the two Alternative Scenarios carried out in the framework of this SEA, the WEM Scenario is clearly less favourable from an environmental and socio-economic point of view compared to the WAM scenario. We therefore conclude the preferred option is WAM.

3.5 ENVIRONMENTAL BASELINE

The main subject of this section is the description of the current state of the environment. When describing the current situation, emphasis will be placed on elements of the current state of the environment. Specifically:

- information provided about the current state of the environment as well as the developments-trends for individual environmental issues
- the most important environmental characteristics as well as those that may be affected are evaluated

Most of the information and data used in this document was collected through the Environmental Protection Information System, which is managed by the Agency, but also through direct cooperation with relevant institutions that have data for the mentioned area, i.e., from the Report on the State of the Environment in the Republic of Serbia for 2020. This information system has become a dominant source of necessary and reliable information in the process of adopting valid European Union standards.

3.5.1 Environmental Areas Examined

The environmental parameters that may be affected by the implementation of the envisaged activities of the Strategy, are assessed in the following chapters.

The environmental areas under investigation include:

- Biodiversity – flora – fauna – protected areas
- Atmosphere
- Climate – climate change
- Acoustic environment – Noise
- Water Resources
- Geology and Soil
- Population – Socio-economic environment
- Human health
- Infrastructure
- Cultural heritage

3.5.2 Biodiversity – flora-fauna-protected areas

3.5.2.1 Flora - Fauna – Habitats

The Republic of Serbia is characterized by great genetic, species and ecosystem diversity. High mountain and the mountainous areas of the Republic of Serbia, as part of the Balkan Peninsula, constitute one of the six centres of European biodiversity. In addition, the Republic of Serbia is potentially one of the global centres of plant diversity in its wealth of flora. Although the Republic of Serbia with its 88,361 km^2 makes up less than 1 % of the European land area, the biological diversity of different groups of living organisms is high.

On the territory of the Republic of Serbia, there is 39 % of European vascular flora, 51 % of European fish fauna, 49 % of reptile and amphibian fauna, 74 % of bird fauna and 67 % of European mammal fauna. The Republic of Serbia has the following characteristics: steppe, zone of deciduous forests, zona of coniferous forests and zona of high mountain tundra. The Republic of Serbia has a heterogeneous flora and fauna, which includes both widespread and endemic species (Balkan, local and rock endemics).

A total of 46 Important Bird Areas (IBA), 62 Important Plant Areas (IPA*) and 40 Important Butterfly Areas have been defined.

During 2020, a new 285 ha of the territory of the Republic of Serbia was protected. A total of 2,633 species of plants, animals and fungi are protected, of which 1,783 species are strictly protected.

The diverse climatic zonal vegetation additionally contributes to the high level of biodiversity of the Republic of Serbia, including a number of extra zonal, intrazonal and azonal ecosystems, such as wetlands, swamps, saline soils and sands.

The total area of protected natural assets is about 691.333 ha, which is 7,81% of the territory of the Republic of Serbia (Report on the State of the Environment, 2016). A total of 468 protected areas and properties are under state protection. During 2021, the protected area was increased by 15,449.16 ha. "Kovačevića Pećina", "Kalemegdanski rt", "Miocenski sprud Tašmajdan", "Tree row of oaks Bačko Petrovo Selo" were declared natural monuments and "Ada and sections near Slankamen", "Maljen", "Ovčarsko-Kablar canyon" were declared as landscapes of exceptional qualities.

In accordance with the national legislation, the procedure for the protection of the natural area is initiated when the Institute for Nature Protection of Serbia submits a protection study to the competent authority and the Ministry of Environmental Protection informs the public about the procedure for initiating the protection of the natural area on the website of the Ministry of Environmental Protection. These areas are considered protected even though no protection act has been passed.

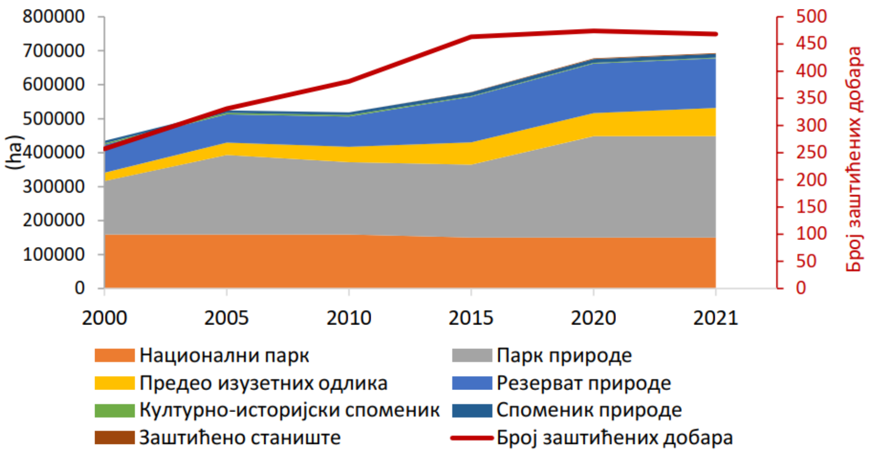

Figure 3.3: Cumulative area and number of protected areas in the Republic of Serbia

The Spatial Plan of the Republic of Serbia ("Official Gazette of the RS", No. 88/10) foresees that by 2021, about 12% of the territory of the Republic of Serbia will be under some form of protection.

In accordance with the EU legislation for nature protection and the regulations of the Council of Europe, the Law on Amendments to the Law on Nature Protection from 2021 ("Official Gazette of RS", no. 36/09, 88/10, 91/10-correction, 14/16, 95/18-dr.law and 71/21) the Ecological Network is established as a coherent, functionally and spatially connected entity for the purpose of preserving habitat types and habitats of wild species of flora and fauna of national and international importance. The ecological network consists of ecologically significant areas of national and international importance and ecological corridors. Potential Natura 2000 areas on the territory of the Republic of Serbia are an integral part of the Ecological Network.

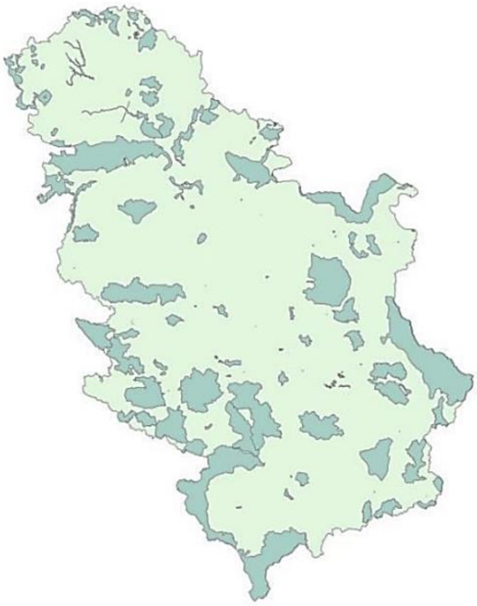

Figure 3.4: Map of the Ecological Network of the Republic of Serbia

The Decree on the Ecological Network ("Official Gazette of RS", number 102/10) identified 101 ecologically significant areas of national and international importance and ecological corridors of international importance in the Republic of Serbia, which represents about 20% of the territory of the Republic of Serbia. The database for the Ecological Network is integrated in the Central Database of the Institute for Nature Protection of Serbia.

The action plan of the Nature Protection Program of the Republic of Serbia for the period from 2021 to 2023 plans, among other things, goals and measures for the establishment and development of a functional ecological network of the Republic of Serbia with a projected increase by 2023 to 22% of the area of ecologically significant areas of international and national importance in relation to the territory of the Republic of Serbia.

Protected areas are specific areas by function and purpose from the point of view of adapting to climate change and in the context of preventing the loss of biodiversity and mitigating the consequences of climate change on biodiversity.

Impact of climate change on biodiversity

Climate change is predicted to have a dramatic impact on biodiversity and ecosystem integrity worldwide. However, it is extremely difficult to predict regional and local impacts, and it is also uncertain how ecosystems will adapt to climate change.

In the Biodiversity Strategy, it is emphasized that in the Republic of Serbia, noticeable changes can be expected in pastures, coastal habitats and forest ecosystems due to changes in the amount and distribution of rainfall per season. Wet and steppe habitats are among the most sensitive. The composition, structure and distribution of forests will change, as certain species will migrate, while others will simply disappear. These consequences will appear mainly because the predicted movement of climate zones will take place faster than the migration of certain species and types of forests. Rising temperatures could increase the frequency and intensity of fires and pests, which in turn could reduce the diversity and extent of forests.

Appropriate parts of the habitat, as well as the possibility of their movement along natural corridors, are today limited due to fragmented landscapes. Given that two-thirds of the territory of the Republic of Serbia consists of mountainous areas, there are species whose population is limited to mountain peaks ("islands") and there are no natural corridors for their migration. Those species will be among those most affected by climate change because they are already vulnerable due to their small populations and isolation. Most of these mountaintop species are endemic or rock-endemic, and if they become more endangered and/or disappear, this will lead to an impoverishment of biodiversity, including a reduction in genetic diversity.

3.5.2.2 Forests

Forests cover 29.1 % of the territory of Republic of Serbia but are under constant danger from phenomena with negative consequences, such as droughts, fires and the spread of pests. For example, in the period from 2003 to 2012, fires covered an area of 36,095 hectares, while it is estimated that the damage caused by them in the period 2000-2009 amounted to 36 billion dinars. Over the past 35 years, there has been a more frequent occurrence of negative factors, such as the decline of groundwater, reduction of precipitation and rising temperatures, which, together with droughts, have significantly contributed to the damage of forest ecosystems.

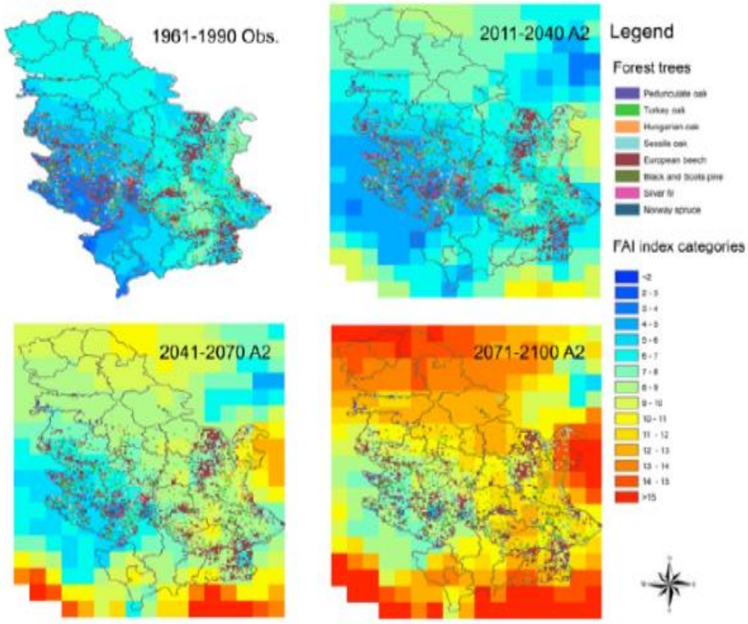

Figure 3.5: Changes in the Forest Index for forests in Serbia according to climate model A2

Climate changes in Serbia also affect the quality of wood, so the estimated losses from poor quality wood are 64 % to 95 % of the forecasted income. For example, since 2000, the Public Company "Vojvodinašume" suffered a loss of 50 million dinars due to the drying of the forest. In the coming decades, it is expected that the increase in temperatures and the variability of precipitation will continue to threaten and endanger the vitality of forests in Serbia. Namely, the conditions for the growth of vegetation and the establishment of new forests will be increasingly unfavourable as time progresses, and many current forests will be found outside their bioclimatic niche and in zones where mass mortality is expected. According to the Forest Aridity Index (FAI), many forests in Serbia will be significantly drier by the end of the 21st century compared to the period 1961-1990 (Figure 3.5), which indicates the existence of problems that Serbia must not ignore.

3.5.3 Air

3.5.3.1 Air quality

In accordance with the Law on Air Protection ("Official Gazette of RS", br. 36/09 and 10/13), the Environmental Protection Agency is obliged to prepare and publish the Annual Report on air quality in the Republic of Serbia every year. The annual report includes data submitted to the Agency by measuring institutions that participate in air quality monitoring at the national and local level.

Air quality in the Republic of Serbia has deteriorated primarily in urban areas or in parts of peri-urban zones. Air quality is affected by emissions of sulfur, nitrogen and carbon oxides, soot and other particles originating from thermal energy plants, industry, transport or individual household burners (Spatial Plan of the Republic of Serbia 2010-2020). Deteriorating air quality occurs in the vicinity of thermal power plants, mining complexes and industrial zones, and in settlements as a result of an increase in the number of motor vehicles. The main reasons for the problem of air pollution are outdated technology, low energy efficiency and the lack of air treatment equipment in the industrial and energy sector, as well as the use of low-quality fuels for heating, the concentration of thermal energy facilities that use lignite as fuel, the poor quality of motor vehicles, etc.

The National Emission Inventory Report, obtained by applying the methodology contained in the EMEP/EEA Air Pollutant Emission Inventory Guidebook 2019, is prepared and submitted every year to the Centre on for Emission Inventories and Projections (CEIP) of the Convention on Long Range Transboundary Air Pollution (CLRTAP). Due to the determined dynamics of data preparation and delivery (once a year, for the past two years), the Report used calculations of the value of emissions in 2020.

According to this methodology, emission sources are classified into 12 sectors: 1) electricity and thermal energy production, 2) industry (use of energy in industry and industrial processes), 3) other stationary combustion (thermal power less than 50 MW and individual combustion plants), 4) fugitive emissions, 5) use of solvents, 6) road traffic, 7) water traffic, 8) air traffic, 9) non-road traffic (railway and others), 10) waste, 11) agriculture-livestock, 12) agriculture-other (without animal husbandry) and others.

According to the report of the Environmental Protection Agency on air quality (2021), the analysis was done for the most important sectors in the Republic of Serbia.

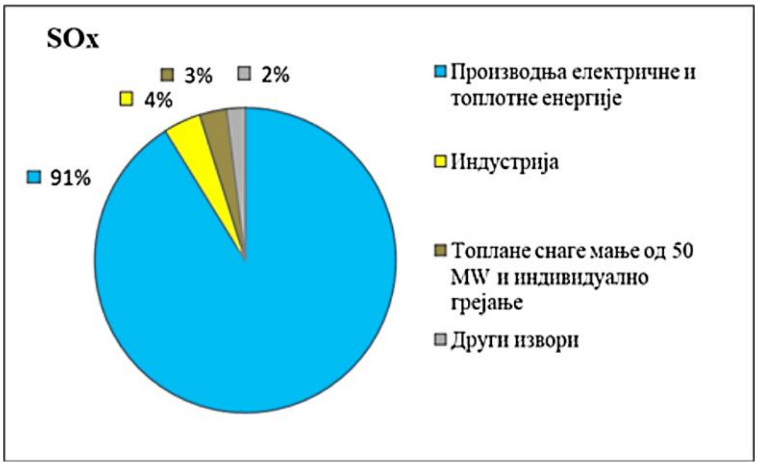

Figure 3.6: Participation of individual sectors in total sulphur oxide emissions in the Republic of Serbia

By analysing the data, it was determined that the total emission of this pollutant in 2021 is 285.77 kt. Electricity and thermal energy production is, with 91%, the dominant source of sulfur oxide emissions in 2020. The industry sector and thermal power of less than 50 MW and individual combustion plants participated with 4% and 3%, respectively, while other sources were negligible (up to 2%).

The energy sector also had a significant share in the total emissions of nitrogen oxides of 54% (Figure 3.7.), while the second place is the road transport with a share of 19%. Industrial emissions accounted for 10% of total national emissions. Agriculture without livestock production accounted for 6% and non-road (railway) transport for 4% share in the emission of nitrogen oxides in this period. By analysing the data, it was determined that the total emission of this pollutant in 2021 is 42.96 kt.

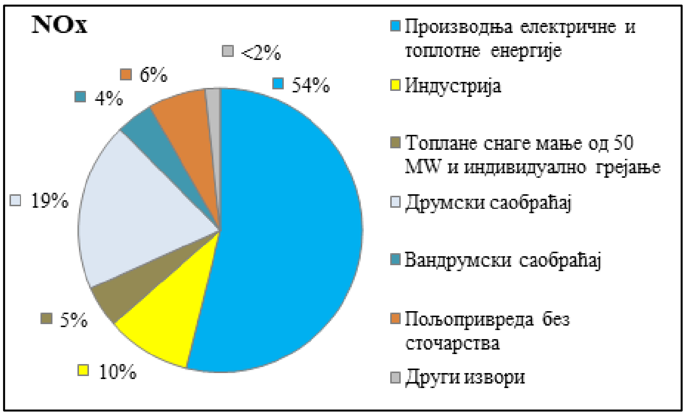

Figure 3.7: Emissions of nitrogen oxides

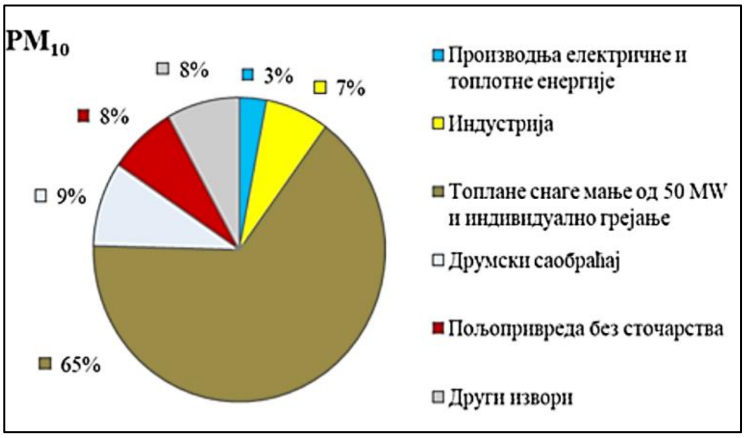

Figure 3.8: Emissions of particulate matter PM10

During 2020, the dominant share of PM10 suspended particle emissions came from heating plants with a capacity of less than 50 MW and individual furnaces, i.e., 65%. In the Republic of Serbia, the road transport sector contributed 9% to national PM10 emissions, followed by agriculture without livestock with 8% and industry with 7%. The electricity and thermal energy production sector emitted 3%, and all other sources participated with 8%.

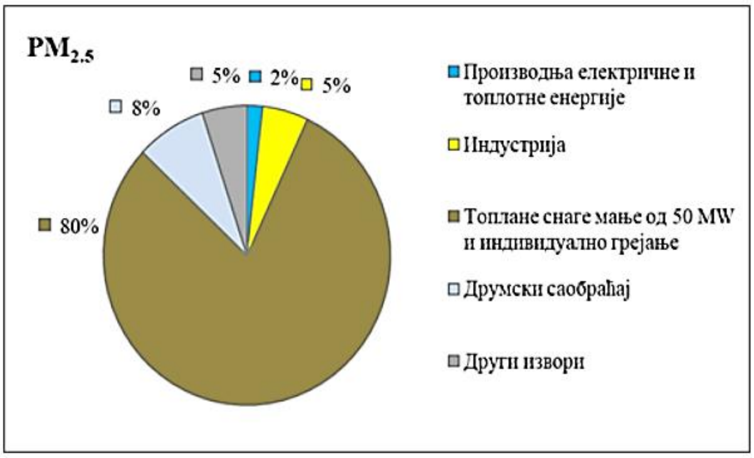

Figure 3.9: Emissions of particulate matter PM 2,5

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The impact of CHP of less than 50 MW and individual furnaces on the total emissions of suspended particles PM2.5 was extremely large and amounted to 80%. Road sector traffic was the second most important source of this pollutant with 8%, the industry sector contributed as a source with 5%, and the electricity and thermal energy production sector with 2%, while all other sources contributed with 5% of total PM2.5 emissions. Through data analysis, it was determined that the total emission of particulate matter in 2021 is 8.66 kt.

The indicator follows the trends of anthropogenic emissions of acidifying gases - nitrogen oxides (NOx), ammonia (NH3), and sulfur oxides (SOx as SO2) in the period 1990 - 2022. The indicator also provides information on emissions by sector according to the EMEP/EEA 2019 methodology.

1) emitted quantities of sulfur oxides show a slight decrease in the period 1990-2020 ;

2) the emitted amounts of ammonia do not show significant changes in the mentioned period.

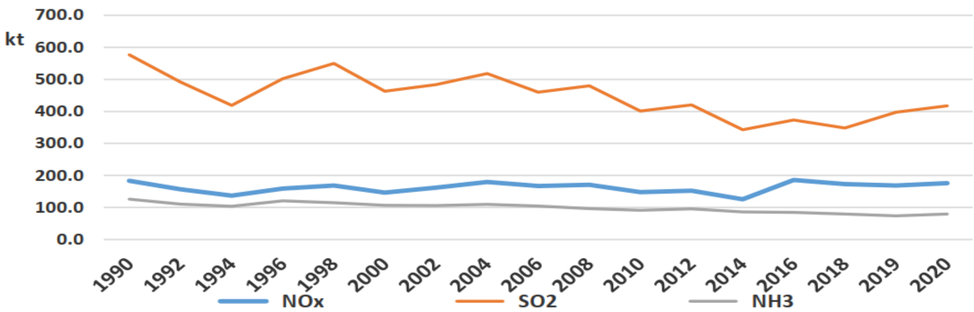

Figure 3.10: Emitted amounts of acidifying gases in the Republic of Serbia in the period 1990-2020

The emission of acidifying gases increases their concentration in the air, which leads to a change in the chemical balance in the environment. The indicator of emissions of acidifying gases in the air covers the following pollutants: NOx, SO2 and NH3. The most significant contribution to the total amount of emitted ḫ acidifying ḫ gases in 2020 is given by "Production and distribution of energy" for NOx - 41.46% and "Road traffic" - 37.77%, and for SO2, "Production and distribution of energy" - 91, 31% and "Agriculture" 89.32% for NH3.

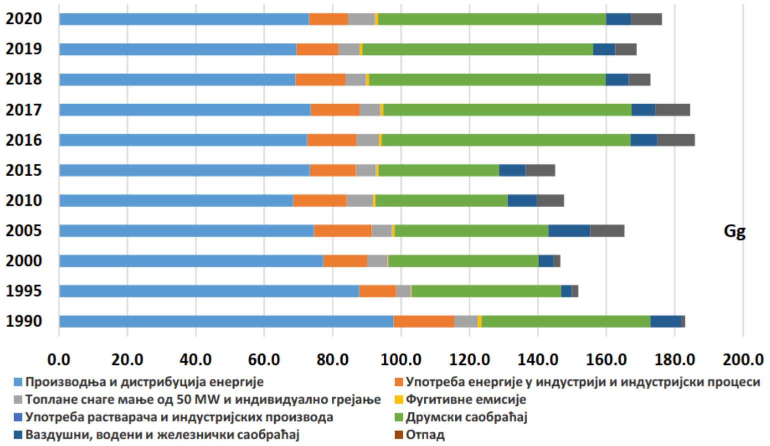

Figure 3.11: Emissions of nitrogen oxides by sector in the period 1990-2020 expressed in thousands of tons

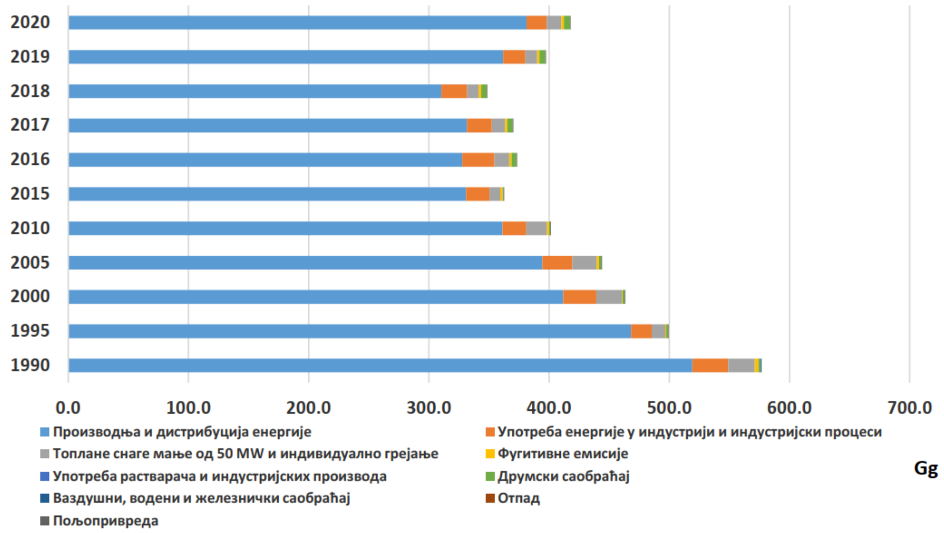

Figure 3.12: Emissions of sulfur oxides by sectors in the period 1990-2020 expressed in thousands of tons

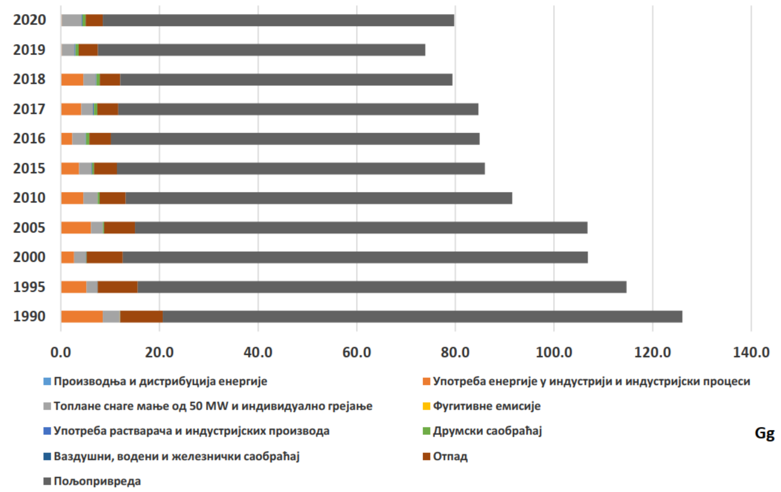

Figure 3.13: Ammonia emissions by sectors in the period 1990-2020 expressed in thousands of tons[10]

Ground-level ozone is a secondary pollutant in the troposphere. It arises in the complex photochemical reactions with the emission of gaseous pollutants - precursors of terrestrial ozone such as nitrogen oxides, non-methane volatile organic compounds (NMVOCs), carbon monoxide (CO) and methane (CH4) Ground-level ozone is a strong oxidizing agent with proven harmful effects on the living world. It represents a significant problem in areas with pronounced photochemical activities such as the Mediterranean area. The indicator also provides information on pollutant emissions by sector in accordance with the EMEP/EEA 2019 methodology.

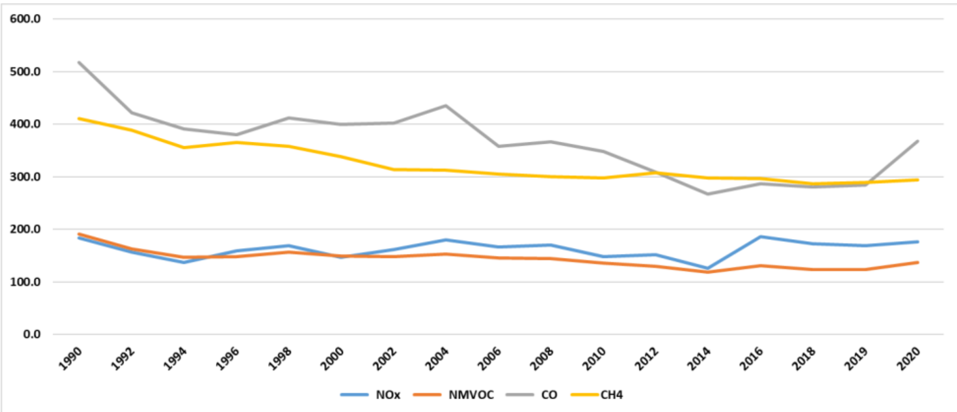

Figure 3.14: Emitted quantities of ozone precursors in the Republic of Serbia in the period 1990-2020

The most significant contribution to the total amount of emissions of ozone precursors is made by "Heating power less than 50 MW and individual heating" (CO - 57.10 %, NMVOC with 21.88 %), "Waste" (CH4 - 35.27 %). A non-negligible share in NMVOC emissions is made by

[10] Data source: National Register of Pollution Sources, Protection Agency environment

"Agriculture" with 17.54 %, "Use of solvents and industrial products" 14.21 %, "Use of energy in industry and industrial processes" with 8.90 % and "Fugitive emissions" with 30.76 % .

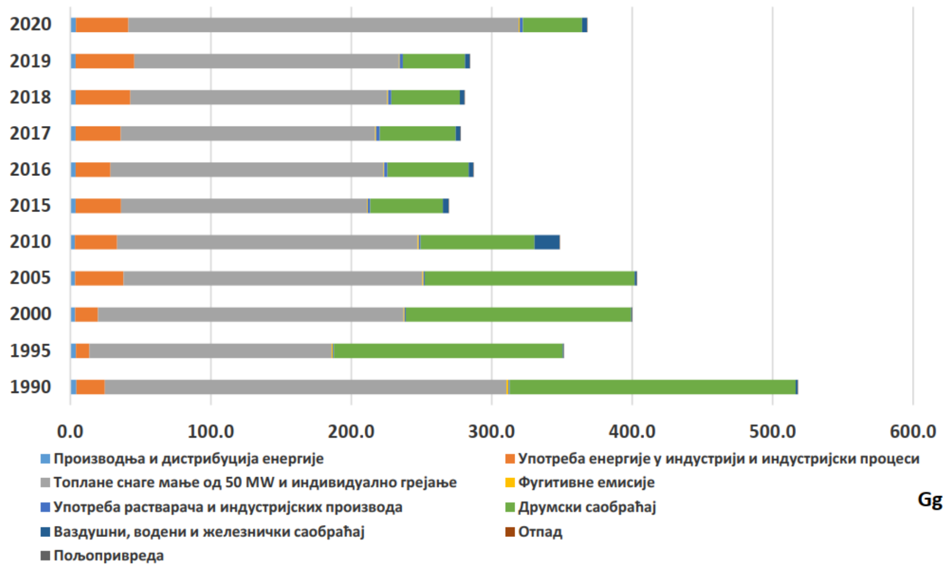

Figure 3.15: Emission of carbon monoxide by sector in the period 1990 - 2020 expressed in thousands of tons

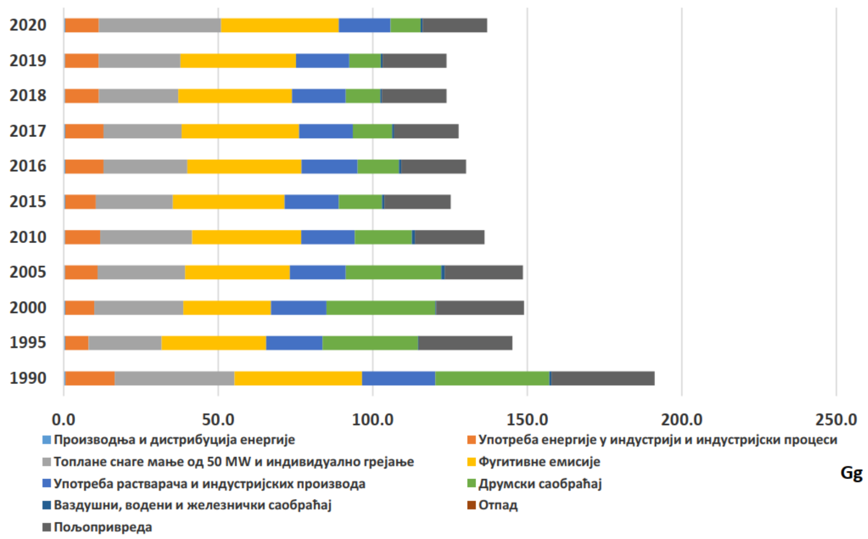

Figure 3.16: NMVOC emissions by sectors in the period 1990 - 2020 expressed in thousands of tons[11]

[11] Data source: National Register of Pollution Sources, Protection Agency vital environment

Suspended particles (dust, smoke, smog) are a mixture of organic and inorganic particles, which are mostly released into the environment during the combustion process fuels in energy, transport and industrial production, but also in manure management .

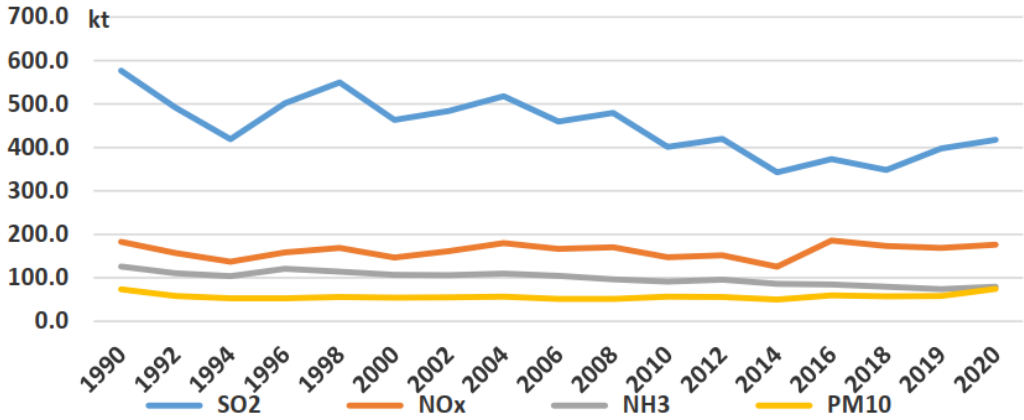

Figure 3.17: Emitted amounts of primary suspended particles and secondary precursors of suspended particles in the Republic of Serbia in the period 1990-2020

The contribution of emissions by sector for NOx, NH3 and SO2 is shown in the CSI 001 indicator, and the share of emissions for PM10 is the highest for "Heating power less than 50 MW and individual heating" about 51.37%, "Energy use in industry and industrial processes" with 12.10 %.

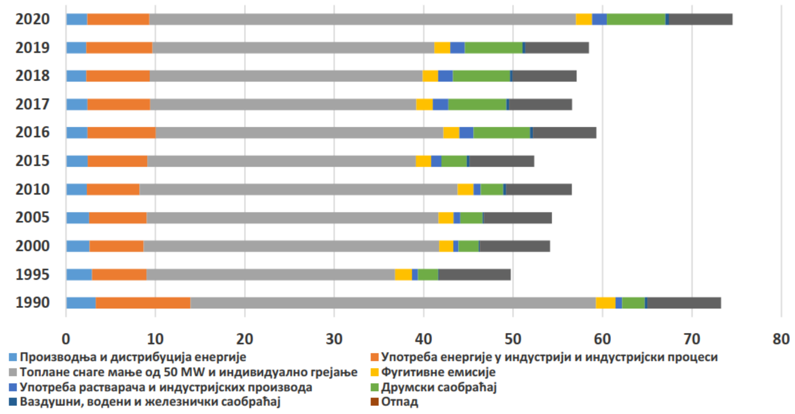

Figure 3.18: Emissions of suspended particles by sector in the period 1990–2020 expressed in thousands of tons[12]

In 2020, the Agency carried out, in accordance with its competences, monitoring air quality in the Republic of Serbia in the network of Automatic quality measuring stations air. New measuring points were established to monitor the concentrations of pollutants in Novi Pazar

[12] Data source: National Register of Pollution Sources, Environmental Protection Agency environment

and Vršac and a measuring point for taking samples of suspended particles in Radinac (Smederevo).

During 2020, there was an increase in the number of cities with excessive air quality pollution.

In the zones of Serbia and Vojvodina, the volume of measurements and submitted data on quality has increased of air in local self-governments, which gave a more detailed picture of the state of air quality.

In the period 2016-2020. Belgrade had excessively polluted air, mainly due to increased concentrations of PM10 and PM2.5, but also due to increased concentrations of NO2 which was case in 2017. The agglomeration of Novi Sad has mostly had clean air in the previous five years, but in 2019. excessive pollution was recorded due to the presence of suspended particles of PM10.

		КАТЕГОРИЈЕ КВАЛИТЕТА ВАЗДУХА				
		2017	2018	2019	2020	2021
ЗОНЕ	СРБИЈА	I	I	I	I	I
	Град Крагујевац	III	III	I	III	III
	Град Краљево	III	III	III	III	III
	Град Зајечар			III	III	III
	Град Ваљево	III	III	III	III	III
	Град Нови Пазар				III	III
	Град Параћин		I	I	III	III
	Град Чачак					III
	Град Лозница					III
	Војводина	I	I	I	I	I
	Град Ср. Митровица	I	III	I *	I	III
	Град Суботица	III	III	III	III	III
	Град Зрењанин			I	III	III
	Град Сомбор					III
АГЛОМЕРАЦИЈЕ	Нови Сад	I	I	III	I	III
	Београд	III	III	III	III	III
	Панчево	III	III	III	III	III
	Смедерево		III	III	III	III
	Бор	I	I	III	III	III
	Косјерић		III	III	III	III
	Ужице	III	III	III	III	III
	Ниш	III	III	III	III	III

Figure 3.19:Trend of air quality by zones, agglomerations and cities in the period 2017-202113

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In the period 2017-2021. Belgrade had excessively polluted air, mainly due to increased concentrations of PM10 and PM2.5, but also due to increased concentrations of NO2, which was the case in 2017 and 2021. In 2021, the agglomeration of Novi Sad again records

[13] Data source: Environmental Protection Agency, GZZJZ BG, PSUZŽS, GP, GU SM, GU UŽ, GU SU, GU NS, GU KV, GU BO, GU SD

excessive pollution due to the presence of suspended particles PM10. For the last three years in a row (2019-2021), pine has been placed in the third category, due to the annual value of sulfur dioxide, while in 2021, the annual limit value of suspended particles of PM10 was exceeded, which also caused the third category - excessively polluted air. The agglomerations of Pančevo, Užice and Niš have been in the third category of excessively polluted air for five years in a row due to pollution with suspended particles PM10 and PM2.5. The agglomerations of Smederevo and Kosjerić had air quality belonging to the third category for four years in a row - excessively polluted air due to pollution with suspended particles PM10 and PM2.5. The air in Valjevo, Kraljevo and Subotica has been excessively polluted in the last five years due to increased concentrations of PM10 and PM2.5.

The city of Sremska Mitrovica, which has variable air quality, was in the third category in 2021 due to increased concentrations of PM10.

The city of Novi Pazar, where polluting substances have been measured since 2020, is in the third category for the second year in a row due to pollution with suspended particles of PM10 and PM2.5. The air in Valjevo, as well as in Užice, has been excessively polluted in the last five years due to increased concentrations of PM 10 and PM 2.5.

The cities of Zaječar and Paraćin (Popovac) were suspended in the third air quality category in 2021 due to the presence of PM10 particles.

The change in air quality according to air quality categories in agglomerations in the period from 2017 to 2021 is given graphically (Figure 3.20). Over time, the percentage of agglomerations for which air quality categorization could not be carried out decreased to 0% as of 2018. 25% of agglomerations had clean air in 2017 and 2018. In 2019 and 2021, not a single agglomeration had clean air. In 2020, there were 13% of agglomerations with clean air. It can also be seen that the second category of moderately polluted air did not occur in any agglomeration, and as of 2021, all tolerance values are equal to the limit, so this category can no longer be used in practice.

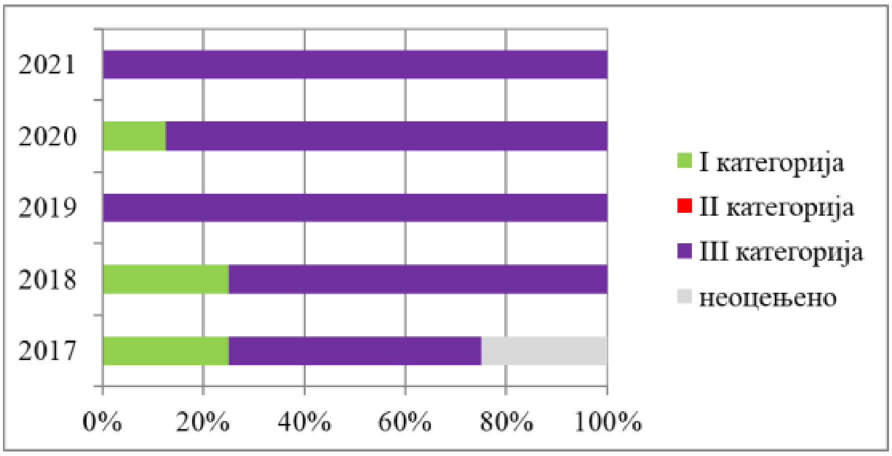

Figure 3.20: Air quality in agglomerations by categories for the period 2017-2021

Pollutants that were measured during 2021 had a different effect on the state of air quality in the Republic of Serbia. The most present were suspended particles PM10, which in 90% of cases appeared as the cause of excessive air pollution due to exceeding the daily threshold value. Other polluting substances were in a much smaller percentage above the permitted ẖ daily ẖ concentration values. Exceeding the ozone target value contributed to air pollution in 8% of cases, and sulfur dioxide in 1%. Nitrogen dioxide with 1% and carbon monoxide with less than one percent share in the total number of exceedances were the least likely causes of air pollution (Figure 3.21).

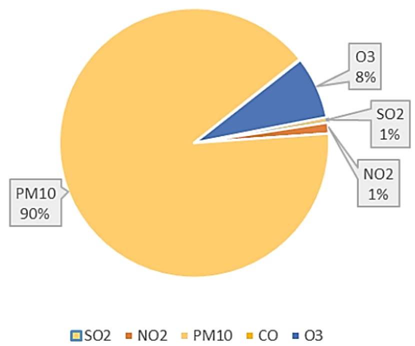

Figure 3.21: Percentage contribution of SO2, NO2, RM10 and SO to occurrences of exceeding the daily limit value and target value of O3 in the Republic of Serbia in 2021

After the tolerance limit was equalized with the limit value for nitrogen dioxide on January 1, 2021, not a single parameter can be characterized by the second category of air quality, as moderately polluted air, but all are classified either in the first category of unpolluted air or in the third category, excessively polluted air (Figure 3.22).

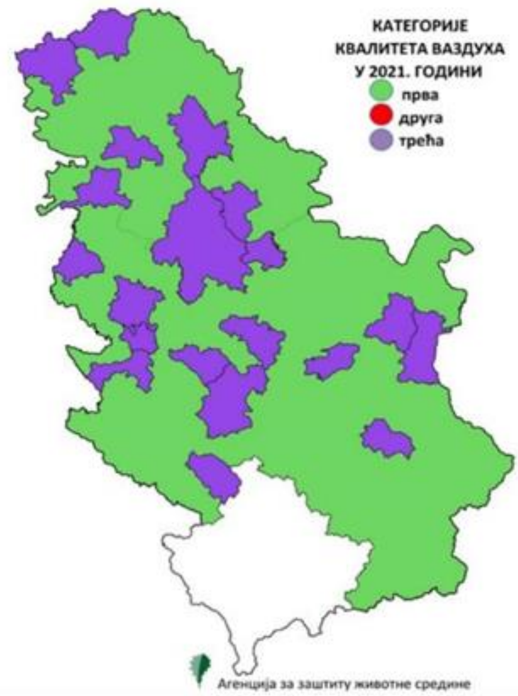

Figure 3.22: Air quality categories by zones, agglomerations and cities in 2021[14]

Finally, by analysing data on air emissions, the biggest sources of sulfur and nitrogen oxides and solid particles are the burning of solid fuel in the production of electricity and heat, as well as burning in households for heating and cooking purposes. It is necessary to single out road traffic as a very significant source of nitrogen oxides. The most significant emitters of ammonia are farms, i.e. raising domestic animals, and especially manure management on them.

3.5.4 Climate – Climate Change

3.5.4.1 Climate

Thanks to the measuring stations in several locations, the multi-decade movement (1961-2017) of temperatures in the territory of Serbia was monitored, where a tendency of the same increase of 0.36°C per decade was recorded, while only in the period 1981-2017, the trend of temperature increase was 0.60°C per decade. Based on this information, it is evident that the average annual temperature increase trend in Serbia is higher than the global average temperature trend.

[14] Data source: Serbian Environmental Protection Agency

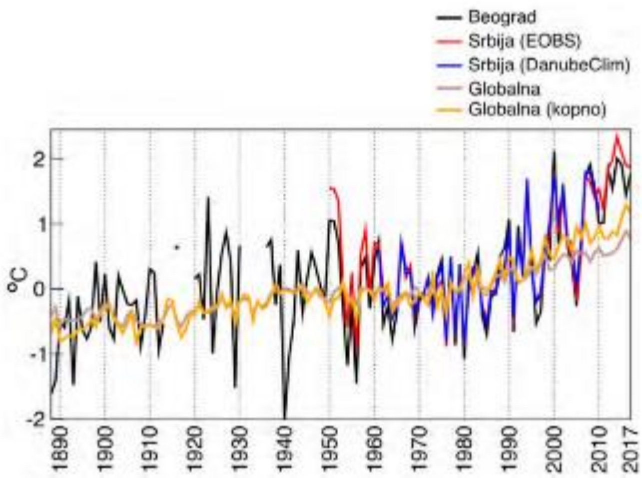

Figure 3.23: Deviation of the mean annual temperature (°C) in relation to the mean value reference period (1961-1990).

Additionally, between 1950 and 2017, nine of the ten warmest years were recorded after 2000.

Furthermore, a trend was observed to increase the duration of heat waves (a heat wave is a period of at least 6 days during which the maximum daily temperature is higher than the expected maximum temperature for the time of year in which it is observed) by 4 days / decade, while at the same time there was a decrease in the number frost days (when the min. temperature is below 0 °C) and icy days (when the observed maximum temperature is below 0 °C), by 2 and 1 day less per decade, respectively. On the other hand, although no significant changes in rainfall have been recorded, it should be emphasized that the Republic of Serbia faced serious droughts and floods during the last decades, which damaged the agricultural sector, infrastructure, housing and other buildings.

In January 2019, the Republic Hydrometeorological Institute of Serbia officially declared 2018 as the warmest year in Serbia.[15] The data were taken from the Global Historical Climatology Network database , which collects meteorological and climatological observations from all over the world, as part of the international data exchange program. The urban heat island effect] has been removed from the time series, since when there are observations. Figure 3.24 shows deviations of the mean annual temperature for Belgrade since 1888.

[15] [http://www.hidmet.gov.rs/podaci/meteorologija/2018.pdf

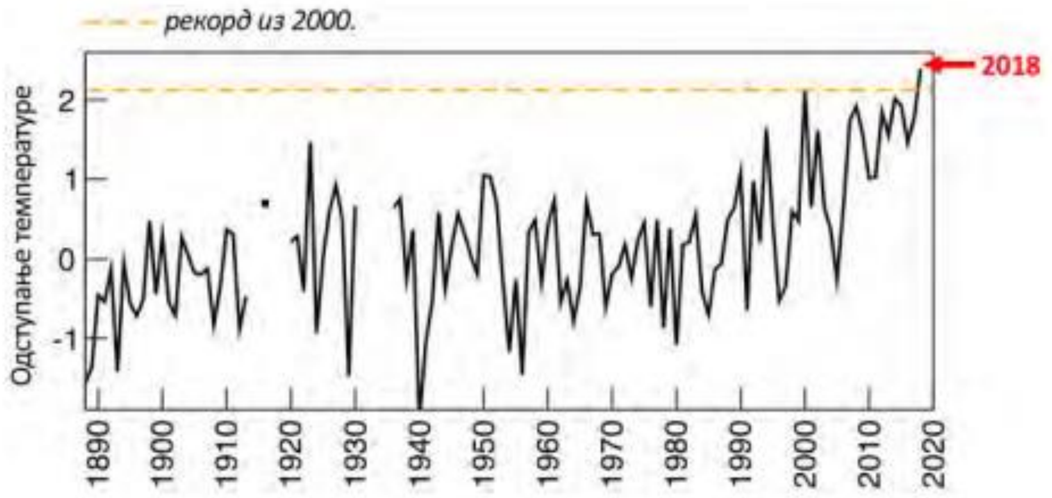

Figure 3.24: Deviation of the mean annual temperature (°C) at the meteorological station of the Observatory in Belgrade, since 1888, in relation to the mean value from the period 1961-1990.

Scientists worldwide are part of the Intergovernmental Panel on Climate Change (IPCC). These scientists found that from 1900 to 2020, the world's surface air temperature increased by an average of 1.1°C due to the burning of fossil fuels that release carbon dioxide and other GHGs into the atmosphere. This may not sound like a big change, but this warming is unprecedented in over 2,000 years of records. Climate models predict that Earth's global average temperature will rise by an additional 4°C during the 21st century if GHG emissions continue to rise at current levels. Without swift action to reduce GHG emissions, models predict that keeping the global average temperature within 1.5-2.0°C may no longer be possible.

If CO2 levels stop rising after 2050, the global average temperature will rise by 1-1.5°C, which is considered the best-case scenario (blue line on the graph). If CO2 emissions are not reduced and the amounts continue to rise, the warming will be 4.5-5°C (red line on the graph).

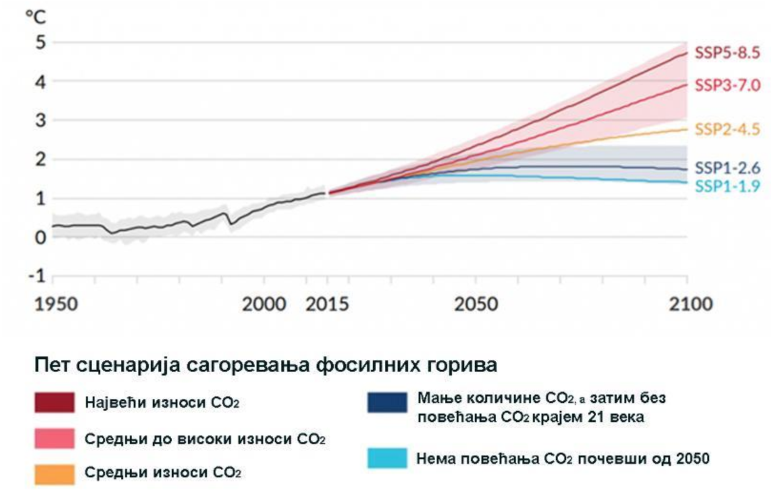

Figure 3.25: Temperature increase until 2100 depending on different scenarios of GHG emissions16

With the help of climate models, climatologists have predicted the movement of the climate in the Republic of Serbia in the following three thirty-year periods: 2011-2040, 2041-2070, 2071-2100. For the period 2011-2040, an increase in the average temperature in the range between 0.5 and 0.9°C is predicted, although that threshold has probably already been reached. In the period 2041-2070, temperatures will be higher by 1.8-2.2°C, while by the end of the century, the temperature is expected to rise by more than three degrees: 3.6-4.0°C. Warming will be most pronounced in the summer season, when temperatures will exceed the threshold of 4.0°C compared to the base period (1961-1990).

The simulations of the movement of precipitation show a positive trend in the first half of the century, that is, an increase of between 5 and 20 %, and then the tendency would reverse and become negative, with a reduction of precipitation of -20 % until the year 2100. Also, similar to temperatures, the negative trend will be more pronounced in summer, which will be 30 % drier compared to the period 1961-1990.

3.5.4.2 Climate change

For the purposes of drafting the Second National Statement of the Republic of Serbia with the UNFCCC, SEPA prepared GHG inventories17 for the period 2000-2014. The data presented below, which refer to the calculation of GHG emissions and emissions in the respective sectors, were taken from the Second National Communication of the Republic of Serbia to the UNFCCC.

Based on the GHG inventory, in 2014 the estimated total emissions in the Republic of Serbia without removal amounted to 67,148.23 Gg CO2 eq. Since 2000, total GHG emissions without

[16] IPCC, 2021. Climate change AR6

[17] Intergovernmental Panel on Climate Change (IPCC) inventory software, the Tier 1 method from the 2006 IPCC Guidelines for GSB National Inventories, and standard emission factors for all source and removal categories were used.

removal have increased by 7.8 %. In 2014, total GHG emissions with sinks amounted to 49,299.24 Gg CO 2 eq, which is an increase of 2.4 % compared to 2000. The biggest share (80.0%) in the total emissions in 2014 was emissions from the energy sector, while the participation of this sector in the total emissions in 2000 was 79.2%. The second largest GHG emitting sector is agriculture, forestry and land use (AFOLU).

In 2014, carbon dioxide (CO2) had the largest share in GHG, expressed as CO2 eq, accounting for 79.7 % of total GHG emissions. Next is methane (CH4) expressed as CO2 equivalent with a share of 13.1 % and nitrogen oxide (N2O) with a share of 6.9 %. Hydrocarbons (HFCs) together accounted for 0.3 % of total GHG emissions in 2014[18].

In 2000, the share of CO2 emissions in total emissions remained the same, 79.7 %. However, the share of CH4 in total emissions decreased by 2.3 %, and N2O increased by 2.0 %. The removal by sinks in forestry during 2014 amounted to -17,848.99 Gg CO2 eq, which is an increase of 26.0 % compared to the removal by sinks in 2000.

The volume of energy consumption has been oscillating for a number of years, and the structure of consumption is constantly dominated by fossil fuels, and in 2020 they accounted for 86.6%. Households have the largest share in final energy consumption with 36%. The objective of the share of renewable energy sources in the final energy consumption by 2020 for the Republic of Serbia is 27%, and in 2019, the share was 21.4%. GHG emission reductions thanks to the use of energy from renewable sources is favourable and in 2019 were estimated at 8.8 million t CO2 eq.

Calculation of GHG emissions by sector

Energy sector

The energy sector is traditionally the main sector that contributes to the GHG inventory in the Republic of Serbia. According to estimates for 2014, emissions from the energy sector amounted to 53,732.71 Gg CO 2 eq, or 80.0 % of total GHG emissions (Second National Report of the Republic of Serbia UNFCCC, 2017). However, these values should be interpreted with caution due to the lack of necessary data, and a final GHG inventory will be developed in a future report. Since 2000, emissions have increased by 9.0 %, mainly as a result of significantly higher consumption of diesel and gasoline in road traffic and moderate fuel consumption in the energy sector.

[18] Data on import and consumption, as well as the available quantities of HFCs, PFCs and SF 6 have been available since 2004 and have been used to estimate the emissions of these gases since then.

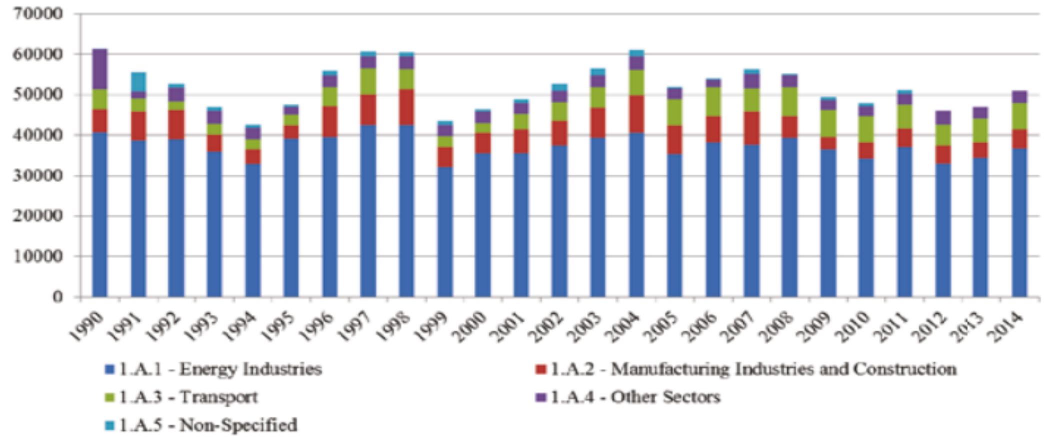

Figure 3.26:GHG emissions by source categories in 1.A fuel combustion in the energy sector (Gg CO2 eq)

Source: Second national statement of the Republic of Serbia to the UNFCCC

Of the total estimated GHG emissions from the energy sector in 2014, 94.8 % came from fuel combustion, of which 71.9 % belonged to the energy sector, 9.6 % to the processing industry and construction, 12.4 % to transport and 6.1 % to other sectors. Of fugitive emissions from fuel, with a share of 5.2 % in total emissions from the energy sector, 60.1 % belong to the extraction, transport and distribution of oil and natural gas, and 39.9 % to solid fuels (domestic coal extraction). It should be borne in mind that the catastrophic floods in 2014, among other things, affected the data collection system, and therefore special attention should be paid to additional analysis and improvement of the GHG inventory for 2014 (Second National Communication of the Republic of Serbia to the UNFCCC).

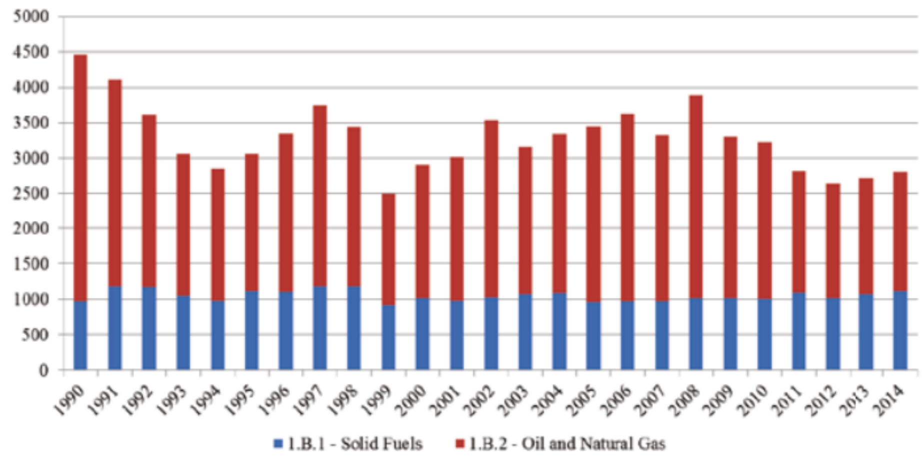

Figure 3.27: GHG emissions by source categories in 1B fugitive emissions from fuel in the energy sector (Gg CO2 eq)

Source: Second national statement of the Republic of Serbia to the UNFCCC

Trends in GHG emissions from the fuel combustion sub-sector in the period 2000-2014. Indicate an increase in emissions from all categories of sources, except for the manufacturing and construction industry (decrease of 2.5 %). The largest increase in GHG emissions in the observed period was recorded in the transport sector (almost triple). This change in emissions is a consequence of the reduction of all economic and other activities, and due to specific national circumstances characteristic of the period up to the year 2000 (sanctions of the international community). Period 2010-2014. are characterized by approximately the same values of GHG emissions, both in total emissions and in the shares of individual subsectors in emissions from the energy sector.

The largest complexes and facilities as emitters of GHG gases in Serbia within the energy sector are thermal power plants in Obrenovac, Lazarevac and Kostalac, then oil refineries in Pančevo and Novi Sad, Bor (complex for extracting and smelting copper, Veliki Krivelj flotation tailings), steel plant in Smederevo and ash landfills in Obrenovac, Lazarevac and Kostolac.

Within the Transport sub-sector, the most significant GHG emitters are the infrastructural Corridor X with branches Xb (Belgrade-Budapest) and Xc (Niš-Sofia), which is the most important road and railway route on the territory of Serbia with 792 km of roads (Strategy for the development of railway, road, inland waterway, air and intermodal transport in the Republic of Serbia, 2008-2015), as well as state roads of category I and II. The main road transport axes Ljubljana – Zagreb – Belgrade – Niš – Leskovac – Skopje – Thessalonica are located within the corridor X; Horgoš – Subotica – Novi Sad – Belgrade (Xb branch); Niš – Dimitrovgrad – Gradina – Sofia (Xc branch). After that, the remaining routes:

- Route 3: connection of Corridor Vc to the Belgrade-South Adriatic route (Bosnia and Herzegovina – Kremna border);
- Route 4: Romanian border- Vršac – Pančevo – Belgrade – Čačak – Užice – Montenegro border;
- Route 5: connection of Corridor Iva with Corridor X (Bulgarian border – Zaječar – Paraćin);
- Route 6: connection of Corridor VIII to the direction Belgrade-South Adriatic (border of Montenegro – Ribarice – Kosovo[*]*)
- Route 7: connection of Corridor X with Kosovo* (Niš – Prokuplje – Kuršumlija – Kosovo*)

The Figure 3.28 presents the GHG in the sub-sector of industrial sectors

[*] Kosovo's designation is without prejudice to positions on status and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo declaration of independence.

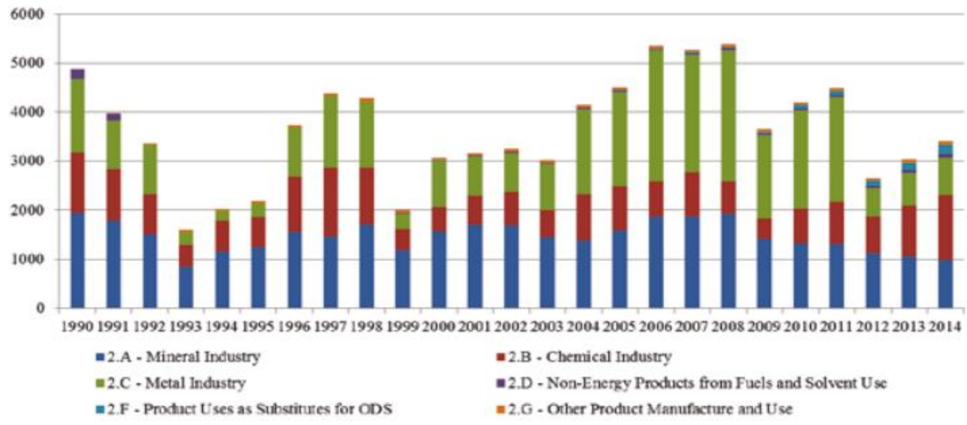

Figure 3.28: GHG emissions in subsector of industrial sectors (Gg CO_2 eq)

Source: Second national statement of the Republic of Serbia to the UNFCCC

The remaining emission sources include use of products containing substances that deplete the ozone layer (5.5 %), use of lubricants and paraffin wax (2.3 %) and N2O from product use (1.9 %).

<u>Sector of industrial processes</u>

In 2014, emissions from the industrial processes sector amounted to 3,402.20 Gg CO2 eq, or 5.1 % of total GHG emissions. Since 2000, emissions from this sector have increased by 10.9% in total, but with significant differences in the participation of individual subsectors: mineral industry (decrease by 37.6%), chemical industry (increased 2.7 times), metal industry (reduction by 18.6 %).

According to estimates for 2014, the largest share in GHG emissions in the sector of industrial processes is emissions from the chemical industry (38.9 %), where the share of production of nitric acid, carbon black and ammonia was 17.0 %, 13.1 % and 8.7 % respectively. The mineral industry followed with 29.0 %, where cement production made the largest individual contribution with 19.6 % to the total emissions from this sector. Production of iron and steel in the metal industry contributed 22.0 % to the total emissions from this sector.

Technologies applied in industrial processes use inefficiently processed materials and energy, there is a lack of exhaust gas treatment and poor operation and maintenance, which generates emissions of pollutants in the air. Some of the most significant GHG emitters in the industrial processes sector in Serbia are cement plants in Beočin, Kosjerić and Popovac; chemical plants in Pančevo, Šabac, Kruševac, steel mills in Smederevo, fertilizer factory Pančevo, industry in Belgrade, Loznica, Šabac, etc.

<u>Sector of agriculture, forestry and other land use</u>

Based on the data for 2017 (mostly similar to those from previous years), it is estimated that the subsidy system adversely affects the reduction of GHG emissions in agriculture, because they are mainly aimed at increasing livestock and used fertilizers, which leads to increased GHG emissions (Strategy of low carbon emission development – result 2).

In 2014, estimated total net removed quantities[19] from agriculture, forestry and of land use (AFOLU) amounted to -11,111.69 Gg CO2 eq. In 2014, emission sources within the AFOLU sector contributed 6,737.29 Gg CO2 eq, of which 3,087.71 Gg CO2 eq (45.8 %) mainly due to direct and indirect emissions of CH4 and N2O from the sector Animal husbandry. GHG emissions from the sector Aggregate sources and non-CO2 sources of emissions to the soil, which include emissions from biomass burning, urea use, soil treatment and management manure, accounted for 49.1 % of the total emissions of the AFOLU sector, i.e., 3,308.67 Gg CO2 eq. Other emissions in 2014 make up about 5 % of emissions and originate from changes in the use of different land categories, such as cropland, grasslands, wetlands, settlements and other land.

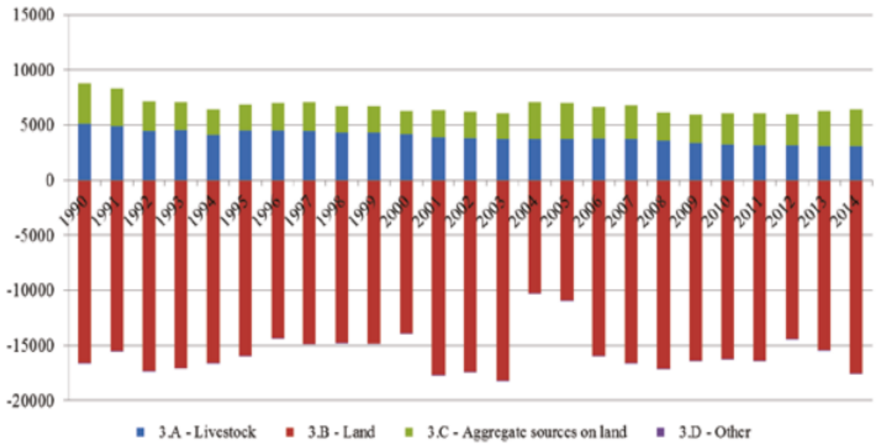

Figure 3.29: GHG emissions in the AFOLU sub-sectors of the AFOLU sector (Gg CO2eq)

Source: Second national statement of the Republic of Serbia to the UNFCCC

On the other hand, the share of emissions from the Land sector and more precisely from the subsector forest land (forestry) and the use of wood products, which removes emissions GHG (sinks), amounted in 2014 to -17,848.08 Gg CO2 eq, i.e., -0.91 Gg CO2 eq, respectively subsectors.

The total net removed quantities from the AFOLU sector have increased since 2000 by 46.8 %, while GHG emissions from the Animal Husbandry sector decreased by 26.4 % in the same period, mainly due to the decrease of the total number of dairy cows by 46.6 % in the period 2000-2014. Emissions from the sector Aggregate sources and non-CO2 sources of emissions to the soil increased by 57.1 % in the period 2000-2014. Due to higher application of urea

[19] Net removal is calculated as the difference between sink removals and emissions by category in the AFOLU sector.

(increase of 2.4 times) and nitrogen synthetic fertilizers and soil treatment (increase of 3.2 times).

Waste Management Sector

In 2014, estimated emissions from the waste sector amounted to 3,276.03 Gg CO2 eq, or 4.9 % of total GHG emissions. Estimated emissions in 2014 were reduced by 1.3 % compared to emissions in 2000 from this sector.

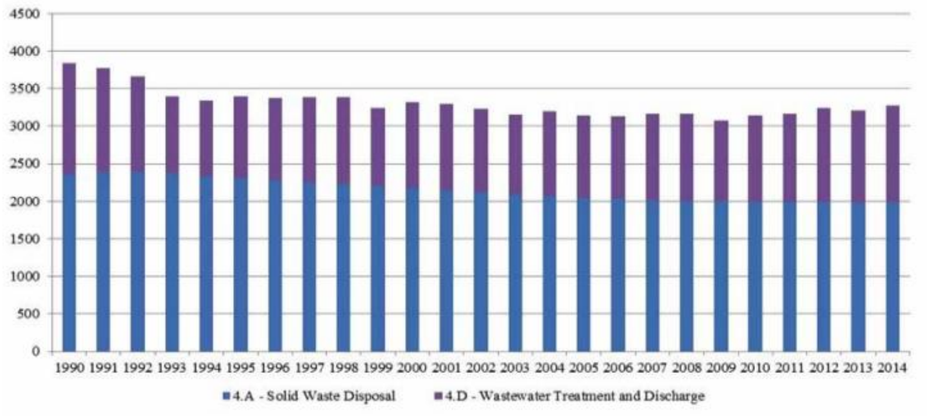

Figure 3.30: GHG emissions by category, in the waste management sector, 1990-2014 (Gg CO_2 eq)

Source: Second national statement of the Republic of Serbia to the UNFCCC

In the waste management sector, 60.7 % of total emissions in 2014 came from the disposal of solid waste on land, and 39.3 % from wastewater treatment. Despite improvements in waste and wastewater management practices in the recent period, the total number of waste management facilities and the amount of processed solid waste and wastewater are still negligible, and the share of GHG emissions from these categories remained almost constant during the observed period.

The following locations in Serbia are considered the largest GHG emitters in the waste management sector:

- 12 regional landfills: "Duboko" Užice, "Vrbak" Lapovo, landfill Kikinda, "Gigoš" Jagodina, "Željkovac – Landfill two" Leskovac, "Muntina padina" Pirot, "Jarak" Sremska Mitrovica, landfill Pančevo, Subotica, Inđija, landfill "Meteris" Vranje and sanitary local landfill in the municipality of Gornji Milanovac;
- 123 municipal landfills (landfills) from which t20 do not comply with minimum technical standards. Some of them are: landfill "Vinča" Belgrade, "Rančevo" Sombor,

[20] SEPA - 44 local self-government units did not send data on the landfills they use, so the number is not final

"Aleksandrovačka bara" Subotica, "Gorić" Valjevo, "Svina" Velika Plana, "Jovanovac" Kragujevac, "Šarica osoje" Užice, "Dobri do" Priboj, "Halovo" Zaječar, "Kulagića ada" Kraljevo, landfill in Silbaš, Bačka Palanka and city landfills in Novi Sad, Vršac, Loznica, Smederevo, Niš, Kruševac.

- 2,170 illegal landfills were registered in accordance with SEPA data from 2016, with a note that 48 municipalities did not submit data on illegal landfills in their territory.

3.5.5 Water Resources

3.5.5.1 Surface Water Resources

Most of Serbia's water resources are transit waters of the Danube, Sava, Tisza and other rivers, while only 9 % are domicile waters. Water regimes on rivers are characterized by spatial and seasonal unevenness.

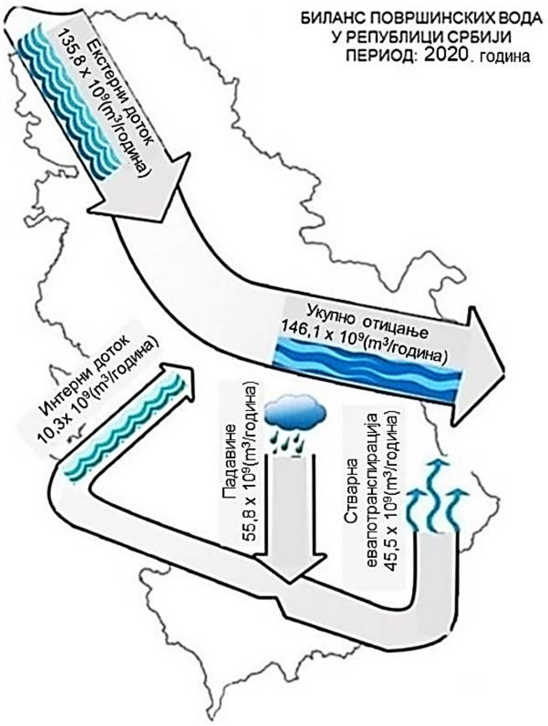

Figure 3.31: Renewable water resources of the Republic of Serbia in 2020[21]

Total affected water resources in the period 2011-2020 have a growing (unfavourable) trend. The average value in the observed period is 4,907 million m3, and the minimum value in this period was in 2014 3,935 million m3 (80.2% of the average value). The maximum value is in

[21] Source: Republic Hydrometeorological Institute of Serbia, Ministry of Environmental Protection, Republic Agency for Environmental Protection)

2019 5,619 million m3, which is 14.5% more than the average value for this period. The long-term average annual value of renewable water resources amounts to 171.39 billion m3 and represents the sum of precipitation in our territory and water inflow from the side minus actual evapotranspiration. The average annual value in 2020 is 14.8% lower than the multi-year average and amounts to 146.1 billion m3.

The territory of Serbia is characterized by pronounced spatial and temporal unevenness of the water regime, and thus regional differences in exploitable possibilities and needs for water.

This means that the western, southwestern, and southern parts of Serbia are richer in water than the northern, central, and eastern parts, and that large amounts of water are present in spring, and less amounts of water in late summer, autumn, and the beginning of winter. The maximum water needs coincide with the minimum water quantities.

The main sources of water pollution in Serbia are untreated industrial and municipal wastewater, runoff water from agriculture, leachate from landfills, as well as pollution related to river navigation and the operation of thermal power plants.

In conclusion about water treatment (Water Treatment Foundation of Serbia), it can be pointed out that the Republic of Serbia has poor drinking water quality. Treatment of water from available sources often results in water with inappropriate physicochemical and microbiological characteristics.

Out of 30 districts, 12 distribute physiochemically defective water to the population. On the other hand, 14 districts deliver water with more than 5 % defective microbiological analyses. Nine districts have microbiologically and physiochemically defective water at the same time. There is not enough information for several districts.

According to the data of the Environmental Protection Agency, the dominant water pollution in the Republic of Serbia with nitrogen and phosphorus originates from municipal and industrial sources, mostly from plants within the energy sector, chemical and mineral industry, as well as public utility companies.

Serbian Water Quality Index (SWQI) monitors nine physicochemical quality parameters (water temperature, pH value, electrical conductivity, percentage of oxygen saturation, BOD_5, suspended matter, total oxidized nitrogen (nitrates + nitrites), orthophosphates and ammonium ion) and one microbiological water quality parameter (the most probable number of coliforms) and provides a measure of the condition of surface waters in terms of the general quality of surface waters without taking into account priority and hazardous substances. The summary value is an anonymous number from 0 to 100 as a quantitative indicator of the quality of a certain water sample, where 100 is the best quality.

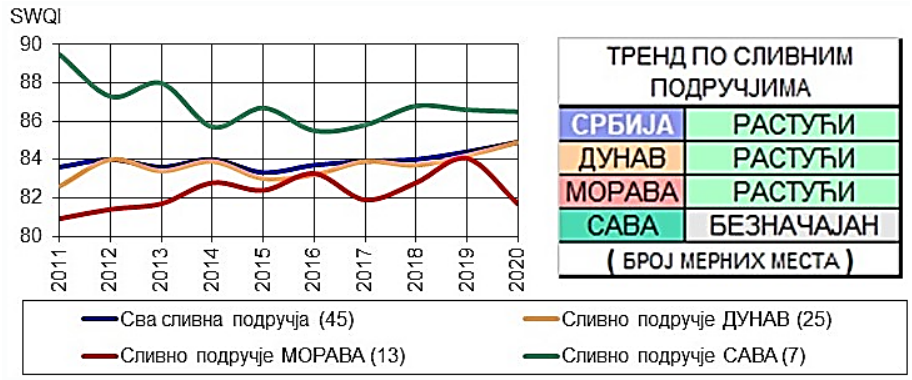

Figure 3.32: Medium SWQI trends in the catchment areas of the Republic of Serbia (2010-2020)

The SWQI analysis was performed at 46 measuring points where, in the period 2010-2020, there is continuity in sampling. On the entire territory of the Republic of Serbia an insignificant trend is determined, favourable (increasing) trend was in the Danube and Morava basin, while an unfavourable (declining) trend was determined in the Sava basin. Medium SWQI values range from 80 to 90, which corresponds to “good” and “very good” quality.

Poor quality according to the SWQI parameter was determined at four (11 %) measurement sites: Bačko Gradište (Channel DTD), Vrbica (Zlatica), Hetin (Stari Begej), Bački Breg (Plazović) and Ristovac (South Morava). In these locations, an insignificant trend was determined, except for Vrbica and Bačko Gradište, where it is favourable (increasing). There is an unfavourable (declining) trend at four (9 %) measuring points,Brza Palanka (Danube), Dimitrovgrad (Nišava), Trnski Odorovci (Jerma) and Mosna (Porečka River), but with very good and excellent water quality.

By analysing 27,291 samples from 261 measuring points sampled on average once a month in the period 1998-2019, the worst situation is in the territory of AP Vojvodina, where 39.5 % of samples are in the “bad” and “very bad” class, and even 67.6 % of the samples are in the “very bad” class are from this territory.

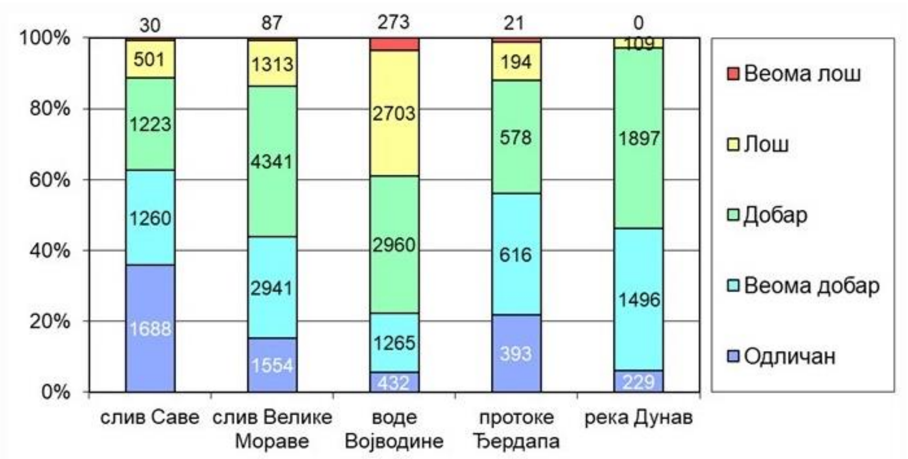

Figure 3.33: Percentage of water quality using the SWQI method in the catchment areas of the Republic of Serbia (1998-2015)

Nitrate analysis was done at 43 measuring points where in the period 2011-2020. there is continuity in sampling. An insignificant trend of medium value of nitrate was determined in the Danube basin and in the entire territory of the Republic of Serbia, while an increasing (unfavourable) trend was determined in the Sava and Morava basins. It is good that the medium values range from 0.5 to 1.31 (mg/l), which corresponds to excellent and good ecological status.

The quality of river water in the Republic of Serbia, in terms of nitrates, belongs to an excellent ecological status at 91% of the measuring sites. An unfavourable (increasing) trend of nitrates was determined at 28% (twelve) measuring sites: Brza Palanka and Radujevac (Danube), Kusiće (Pek), Jamena and Šabac (Sava), Ljubičevski Most (Velika Morava), Kraljevo (West Morava), Ristovac and Mojsinje (South Morava), Dimitrovgrad (Nišava), Trnski Odorovci (Jerma) and Mrtvine (Gaberska Reka). It is good that the mean nitrate values at these measuring points are low and within the limits of excellent ecological status.

The content of nitrates in watercourses of the Republic of Serbia in 2020 is the lowest compared to the observed period 2011-2020.

Analysis of orthophosphate was done at 43 measuring points where in the period 2011-2020. there is continuity in sampling. In all catchment areas and the entire territory of the Republic of Serbia, an insignificant trend of orthophosphate was determined. Medium values of orthophosphate range from 0.019 to 0.1 (mg/l), which corresponds to a good ecological status. The quality of river water in the Republic of Serbia, in terms of orthophosphate, does not belong to a good ecological status at eight (19%) measurement sites. The worst situation is at the measuring points in AP Vojvodina: Bački Breg (Plazović) with an insignificant trend and an average ten-year concentration of 0.585 (mg/l), Ḫetin (Stari Begej) 0.392 (mg/l) with an insignificant trend and Vrbica (Zlatica) 0.246 (mg/l) with a favourable (declining) trend in the observed period.

Bački Breg (Plazović) 0.35 (mg/l) and Ḫetin (Stari Begej) 0.44 (mg/l) have an average concentration higher than 0.2 (mg/l) in 2020. According to the orthophosphate indicator, water quality is the best in 2020 compared to the period 2011-2020.

The analysis of BOD-5 was done at 36 measuring sites where, in the period 2011-2020. there is continuity in sampling. An insignificant trend in the medium value of BOD-5 was determined in all catchment areas. Medium values range from 1.39-2.8 (mg/l), which corresponds to a good ecological status.

An unfavourable (increasing) trend of BOD-5 was determined at 17% (six) measurement sites: Zemun and Smederevo (Danube), Badovinci (Drina), Lešnica (Jadar), Kraljevo (West Morava) and Trnski Odorovci (Jerma). It is favourable that at these measuring points the average ten-year value of BOD-5 is low. The higher average 10-year BPK-5 value is only at the measuring site Bačko Gradište (Kanali DTD) in AP Vojvodina, and is 5.93 (mg/l), which represents 3% of the measuring site. An insignificant ten-year water quality trend was determined at this location.

In 2020, according to the BPK-5 indicator, water quality slightly worsened compared to 2019. Only at one measuring point, Bačko Gradište (DTD canals) in 2020, the concentration of BOD-5 was higher than 4 (mg/l) and amounted to 5.79 (mg/l)

Ammonium analysis was done at 43 measuring points where, in the period 2011-2020 there is continuity in sampling. An unfavourable (increasing) trend of the ammonium medium value was determined in the Sava catchment area. An insignificant trend in the same period is in the Morava and Danube basins as well as in the entire territory of the Republic of Serbia. Medium values range from 0.06 to 0.19 (mg/l), which corresponds to a good ecological status.

An unfavourable (increasing) trend of the mean value of ammonium was determined, in the period 2011-2020, at 14% (six) measuring points in the Republic of Serbia. In the Sava basin, an unfavourable (increasing) trend was determined at 60% (three out of five) measuring points, but it is good that ammonium concentrations in the Sava basin are low because they do not exceed 0.1 (mg/l).

According to the indicator that monitors the ammonium content, the water quality in the watercourses of the Republic of Serbia improved in 2020 compared to 2019.

Ammonium analysis shows a good ecological status, but an unfavourable (increasing) ammonium trend was determined in the Sava catchment area. An insignificant trend in the same period is in the Morava and Danube basins as well as in the entire territory of the Republic of Serbia.

3.5.5.2 Groundwater

The natural quality of groundwaters in the territory of Serbia is rather uneven, which is the consequence of different mineralogical-petrographic composition of the water bearing environments, the genesis of groundwaters and aquifers, age of the water, different intensity of water exchange etc. It ranges from exceptional quality which does not require any treatment to waters which require very complex conditioning procedures prior to their use for public water supply.

Groundwater is excessively consumed, for example in some parts of Bačka and Banat, the level of groundwater in the basic aquifer complex has dropped by 30 m or more, which means that there is a very real danger that water of significantly lower quality will be drawn from the deeper layers.

To assess the quality of groundwater, the Environmental Protection Agency monitors the concentration of nitrates (NO_3). The excessive amount of nutrients that sinks into the soil from urban areas, industry and agricultural areas leads to an increase in concentration, which causes groundwater pollution. This process has a negative impact on the use of water for human consumption and other purposes. In the period 2008-2018. In the entire territory of the Republic of Serbia and in all catchment areas, an insignificant trend of nitrates was recorded (Figure 3.34).

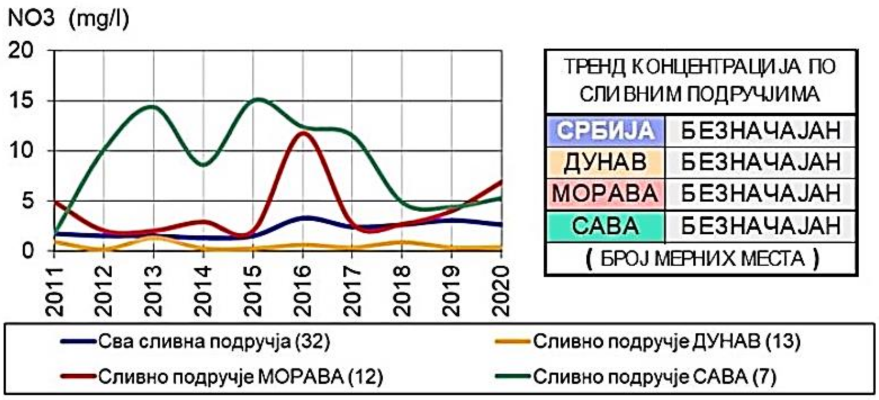

Figure 3.34: Medium nitrate trends in the groundwater of the Republic of Serbia (2011-2020)

Analysis of groundwater nitrates was done at 32 measuring points where, in the period 2011-2020, there is continuity in sampling. In the entire territory of the Republic of Serbia and in all catchment areas, an insignificant trend of nitrates was recorded, which means that there are no significant changes in quality (Figure 3.34).

The ten-year average concentration higher than 50 (mg/l) was determined only at the Šid (Š-1/D) measuring site (51.7 mg/l) in the Sava basin in the period 2011-2020. A relatively high ten-year average concentration of more than 25 (mg/l) was determined at the measuring points Novi Sad (RŠ-1/1) (30.9 mg/l) and Zrenjanin (ZR-1/D) (26.7 mg/l l) in the Danube basin and LozovikVlaški Do (40 mg/l) and Obrež-Ratare (27.4 mg/l) in the Morava basin.

In 2020, the permitted nitrate concentration of 50 (mg/l) was exceeded only at the measuring points Zrenjanin (ZR-1/D) (97.4 mg/l) in the Danube basin and Lozovik-Vlaški Do (51.4 mg/ l) in the Morava basin. The quality of underground water in 2020 is worse than in 2019 and 2018.

3.5.5.3 Transboundary Issues

The Republic of Serbia cooperates with the countries in the region on issues of water quality control and transboundary water pollution. International cooperation primarily refers to water quality of the Danube, Sava, Tisa, Tamiš and Drina rivers. The Danube River water is of particular interest for the Republic of Serbia primarily because of public water supply, i.e. the protection of groundwater in the South Bačka and the South Banat against the pollution. The pollution of the Danube River water also affects water quality of the Djerdap Lake. Furthermore, developing the regional cooperation in the field of water resources management is also of great importance. To this end, the sustainable water management, regulation of the use and protection of water and aquatic ecosystem, as well as protection of water against negative impacts, have been carried out based on the ratification of the Convention on Co-operation for the Protection and Sustainable Use of the River Danube and signing of the Framework Agreement on the Sava River Basin.

3.5.6 Geology and Soil

The geological structure of Serbia is characterised as predominantly complex, both with regard to lithofacies and tectonic characteristics. The structure of the terrain includes magmatic, sediment and metamorphic rock, formed from the Precambrian to the contemporary Holocene strata periods.

Soil properties depend on a large number of natural factors, such as physical-chemical properties, geological subsoil, hydrogeological and hydrographical conditions, orography, climate, vegetation, presence of macro and microorganisms. Soil formation, including its regeneration, is a very slow process, so that soil may be regarded as a partially renewable resource. Apart from natural conditions and processes, soil properties and its degradation is significantly shaped by constant pressures of human activities, including mining, community development, infrastructure development, agriculture, forestry, use of chemicals and so on.

In the area of central Serbia, slightly acidic to acidic soils dominate, carbonate-free to slightly carbonated, slightly humous to humous, with low and high with the content of readily available phosphorus and soil with an optimal and high content readily available potassium. Systematic control of the fertility of arable agricultural land is carried out determining the level of nutrients in agricultural land, and in order to ensure proper use of mineral and organic fertilizers.

The examination includes the analysis of the basic chemical properties of agricultural lands in within fertility control: substitution acidity (pH in H2O and nKCl), CaCO3 (%), humus (%), N (%) and easily accessible forms of phosphorus (P2O5 – mg/100 g) and potassium (K2O – mg/100 g).

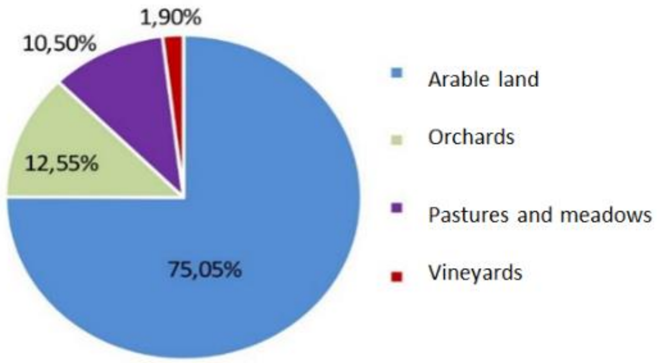

Figure 3.35: Percentage share of samples according to land use

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Out of a total of 31,245 tested agricultural soil samples taken from a depth of up to 30 cm, 75.04 % belongs to arable land and gardens, 12.55 % to orchards, 1.90 % to vineyards and 10.50 % pastures and meadows.

The test results show that the largest number of soil samples taken from arable land and gardens, orchards, vineyards, pastures and meadows belong to the class of slightly acidic reaction (pH in nKCl 5.5-6.5) .

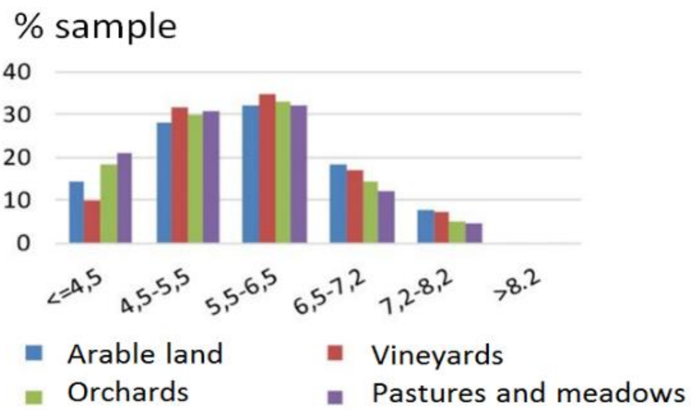

Figure 3.36: Substitutional acidity (pH in nKCl)

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The results of testing the content of $CaCO_3$ show that in vineyards and pastures and meadows low carbonate soils ($CaCO_3$ 0-2 %) are represented .

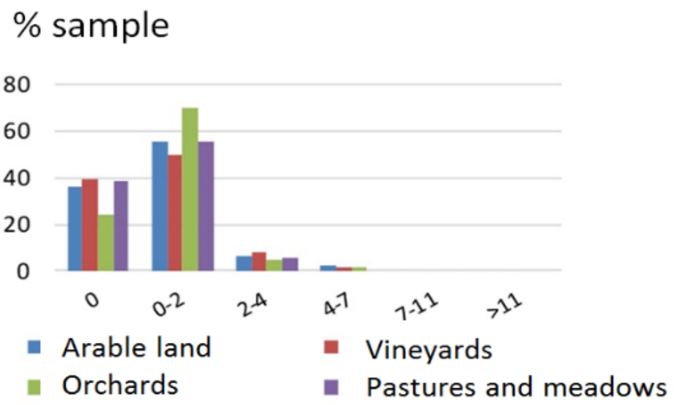

Figure 3.37: CaCO3 content (%)

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Humus analysis shows that arable land, gardens and vineyards mostly belong to this class low humus soils (1-3 % humus), while pastures and meadows, as well as orchards are in the class humus soils (3-5 % humus) .

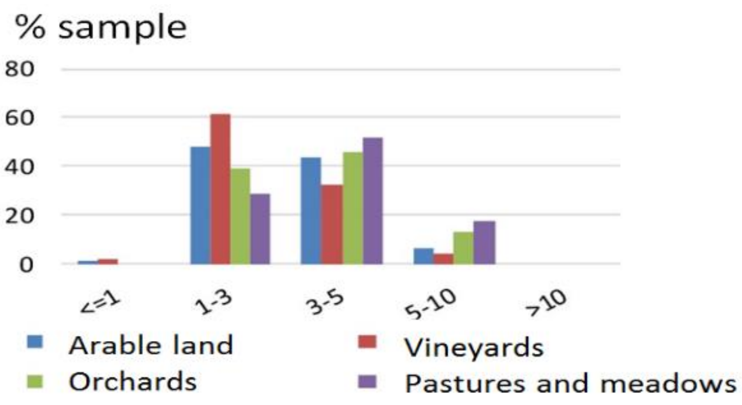

Figure 3.38: Humus content (%)

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The results of the analysis of readily available phosphorus show that the largest number of samples of arable land and gardens, orchards, pastures and meadows are in the class of high content of readily available phosphorus (P_2O_5 25-50 mg/100 g), while the vineyards are in the class of low content (P_2O_5 5-10 mg/100 g).

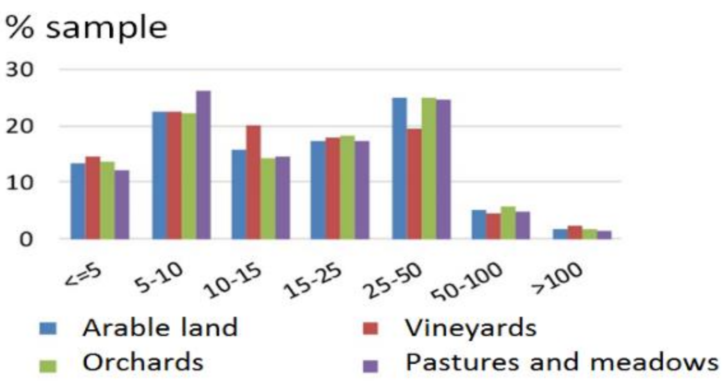

Figure 3.39: Content of easily accessible forms of phosphorus (P2O5 mg/100g)

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The analysis of the content of easily accessible potassium shows that the soils are provided to the greatest extent with optimal and high content of potassium (K2O 15-25 and 25-50 mg/100 g).

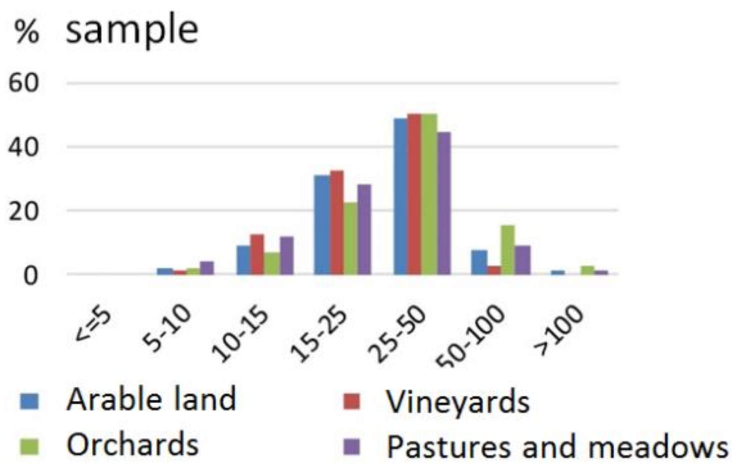

Figure 3.40: Content of easily accessible forms of potassium (K2O mg/100g)[22]

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Analysis results of a total of 34,995 soil samples within the framework of fertility control of agricultural land in the territory of central Serbia show that 55.7 % of the samples have low content of organic carbon (1.1-2 %). Medium organic carbon content (2.01-6 %) has 36.8 % of samples, very low content (<1 %) has 7.3 % of samples, while only 0.2 % has high content (<6 %)

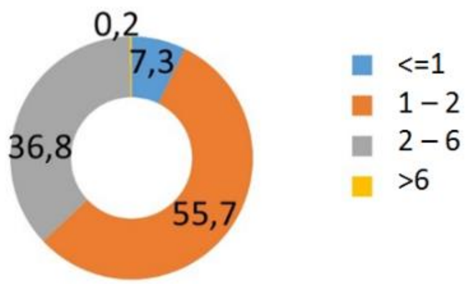

Figure 3.41: Organic carbon content (OC)

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[22] Data source: Ministry of Agriculture, Forestry and Water Management - Sector

Based on data on humus content in agricultural land in the territory central of Serbia in 34,995 samples from a depth of up to 30 cm, the average organic content was obtained carbon, which is 1.9 % and is in the category of low content (1.01-2.0 %). Arable land and gardens, as well as vineyards and orchards, are dominantly in the low category of organic carbon content (Table 3.13**Error! Reference source not found.**).

Table 3.13: Share of categories of organic carbon content according to the method of use agricultural areas in the territory of central Serbia (%)[23]

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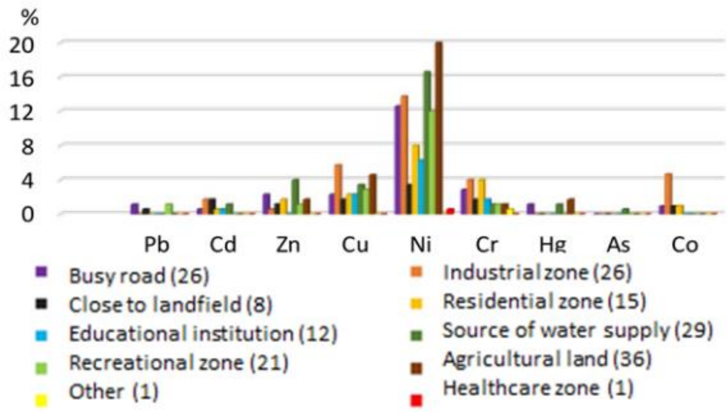
Land use method (number of analyzed samples)	Very low (≤1.0%)	Low content (1.01-2.0%	Medium content (2.01-6.0%)	High content (>6.01%)
Vineyards and orchards (6,128)	7	53	39.7	0.3
Pastures and meadows (3,478)	4.3	39.6	66.7	0.4
Arable land and gardens (25,289)	7,8	59.5	33.5	0.2

In 2020, the degree of soil endangerment from chemical pollution was monitored in urban zones in eight local self-government units, a total of 248 samples were examined, the most frequent exceeding of limit values was recorded for Ni, Cu, Cr, Zn, Cd, Pb, As, Co and Hg.

The indicator monitors the degree of soil endangerment from chemical pollution in urban areas environments based on exceeding the limit and remediation values of dangerous and harmful matter in accordance with the Regulation on limit values of polluting, harmful and dangerous substances matter in the soil ("Official Gazette of RS", no. 30/18 and 64/19).



[23] Data source: Ministry of Agriculture, Forestry and Water Management

Figure 3.42: Exceeding limit values & number of tested samples at a depth of 0-30 cm

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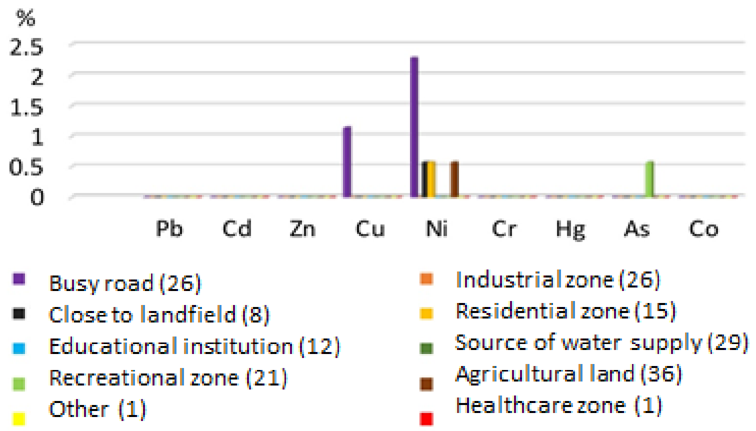

Figure 3.43: Exceedances of remediation values & number of tested samples at a depth of 0-30 cm

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In the territory of the city of Belgrade, the results show exceeding the limit value for Zn, Cu, Ni, Cr and Hg in the zone of the source of water supply, the residential zone, the recreational zone and the zone of agricultural land, while the remediation value was exceeded for Arsenic in recreational zone in one sample.

In the city of Niš, the limit value for Cd, Cu, Zn, Ni, Cr and Co in the soil samples was exceeded in the industrial zone, the traffic area, near the landfill and residential and recreational zone. The remediation value was not exceeded in any sample.

On the territory of the city of Kruševac, concentrations in soil samples were elevated in industrial zone, residential zone, traffic zone and agricultural land zone for Pb, Zn, Cu, Ni, Sr and Hg, while remediation values were exceeded for Ni in the traffic roads zone in four samples, residential zone in one sample and zone of agricultural land in one sample.

In the city of Čačak, the highest concentrations of Ni and Cr are in the industrial zone and the traffic zone traffic roads.

Limit values in the city of Požarevac were exceeded for Zn, Cu and Ni in the vicinity of the road zone, industrial zone, in samples of agricultural land, recreational zone and the water supply source zone.

In the territory of the city of Smederevo, the limit value was exceeded for Pb, Cd, Zn, Cu, Ni and Cr, in the recreational, industrial and pedagogical institution zone, near landfills, springs water supply and agricultural land, while the remediation value for Ni exceeded near the landfill in one sample.

In the municipality of Trstenik, the limit values for Zn, Cu, Ni and Hg were exceeded in the zone of agricultural land.

In the municipality of Vladimirci, the results show exceeding the limit value for Ni in the pedagogical institution zone, the recreation zone, as well as in the zone of agricultural land.

Data source: city and municipal administrations of Belgrade, Kruševac, Niš, Čačak, Pozarevac, Smederevo, Trstenika and Vladimirci.

In the territory of the Republic of Serbia in 2020, 213 locations were identified in categories of potentially contaminated.

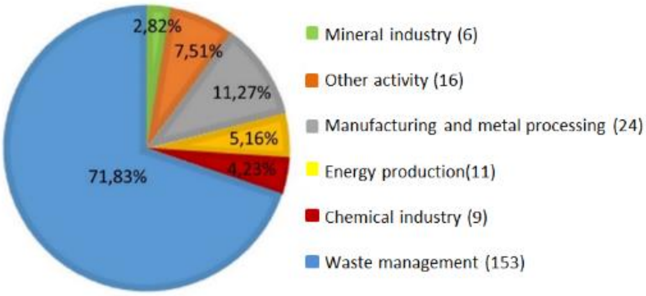

Figure 3.44: Share of the main localized sources of soil pollution in the total number of identified locations (%)

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Based on the submitted data, 213 locations were identified in the territory of the Republic of Serbia where activities from the Rulebook on the list of activities that can cause soil pollution and degradation, procedure, data content, deadlines and other requirements for soil monitoring ("Official Gazette of RS", No. 102/20).

Out of the total number of reported locations, 21 companies submitted a soil monitoring report. Based on the Rulebook on the Content and Method of Keeping the Contaminated Sites Cadaster, Content, Forms, Method and Deadlines for Data Submission ("Official Gazette of RS", No. 58/19), the analysis results show that it was confirmed in six companies the presence of polluting, harmful and dangerous substances in concentrations above remediation values, in accordance with the Regulation on limit values of polluting, harmful and dangerous substances in the soil ("Official Gazette of RS", no. 30/18 and 64/19).

The largest share of identified locations are waste management locations – 71.83 %, within which there are unsanitary landfills – garbage dumps, which are managed by local self-government units.

Figure 3.45 shows basic characteristics of the locations of unsanitary landfills – garbage dumps related to potential soil pollution.

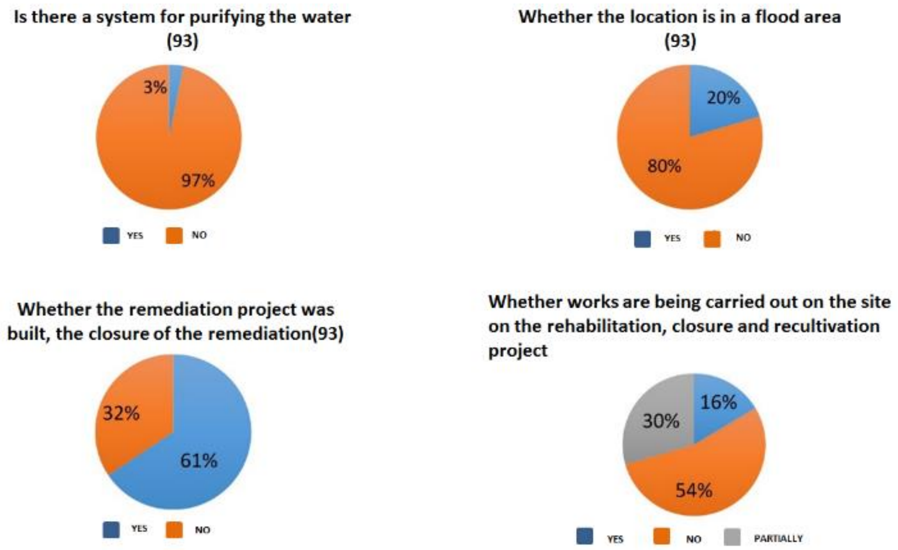


Figure 3.45: Basic characteristics of the locations of unsanitary landfills (total number of responses)

Annual report on the state of the environment in the Republic of Serbia for 2020

Based on the Report of the Ministry of Mining and Energy, data on degraded area and disposed tailings from larger mining companies in the Republic Serbia, which have significant pollution.

Table 3.14: Data on degraded area and land degraded by tailings disposal from larger mining companies in the Republic of Serbia that have significant pollution[24]

Economic Society	Land degraded by excavation (ha)	Land degraded by tailings disposal (ha)
Electric power industry of Serbia	158.77	0.00
CRH Serbia	1.37	1.63
Concern Farmakom Rudnik Lece	0.00	20,10
Serbia Zijin Copper Pine	20,10	56,68
South-Kaolin	1.19	1.60
Bosil-Metal		0.30
PC for underground coal mining	13.93	2.69
In total	195.35	85.00

[24] Data source: Ministry of Mining and Energy, Environmental Protection Agency environment

3.5.7 Population – Socio-economic Environment

3.5.7.1 Administration

Serbia is divided into **145 municipalities and 29 districts**, which form the basic units of local government. Districts form the first-level administrative divisions of Serbia.

Regarding the districts there are 8 in Šumadija and Western Serbia, 9 in Southern and Eastern Serbia, 7 in Vojvodina), plus the City of Belgrade. The City of Belgrade is not part of any district but has a special status very similar to that of a district.

Each municipality has its own assembly (elected every four years in local elections), a municipal president, public service property and a budget. Municipalities usually have more than 10,000 inhabitants.

Table 3.15: List of districts

Šumadija and Western Serbia

District	Seat	Area in km2	Population in 2011	Population per km2	Municipalities & cities	Settlements
Kolubara District (Kolubarski okrug)	Valjevo	2,474	174,228	70.4	• Osečina • Ub • Lajkovac • City of Valjevo • Mionica • Ljig	218
Mačva District (Mačvanski okrug)	Šabac	3,268	297,778	91.1	• Bogatić • City of Šabac • City of Loznica • Vladimirci • Koceljeva • Mali Zvornik • Krupanj • Ljubovija	228
Moravica District (Moravički okrug)	Čačak	3,016	212,149	70.3	• Gornji Milanovac • City of Čačak • Lučani • Ivanjica	206
Pomoravlje District (Pomoravski okrug)	Jagodina	2,614	212,839	84.8	• City of Jagodina • Ćuprija • Paraćin • Svilajnac • Despotovac • Rekovac	191

District	Seat	Area in km2	Population in 2011	Population per km2	Municipalities & cities	Settlements
Rasina District (Rasinski okrug)	Kruševac	2,667	240,463	90.2	• Varvarin • Trstenik • Ćićevac • City of Kruševac • Aleksandrovac • Brus	296
Raška District (Raški okrug)	Kraljevo	3,918	300,102	76.6	• City of Kraljevo • Vrnjačka Banja • Raška • City of Novi Pazar • Tutin	359
Šumadija District (Šumadijski okrug)	Kragujevac	2,387	290,900	121.8	• Aranđelovac • Topola • Rača • Batočina • Knić • Lapovo • City of Kragujevac	174
Zlatibor District (Zlatiborski okrug)	Užice	6,140	284,729	46.4	• Bajina Bašta • Kosjerić • City of Užice • Požega • Čajetina • Arilje • Nova Varoš • Prijepolje • Sjenica • Priboj	438

Southern and Eastern Serbia

District	Seat	Area in km2	Population in 2011	Population per km2	Municipalities & cities	Settlements
Bor District (Borski okrug)	Bor	3,507	123,848	35.3	• City of Bor • Kladovo • Majdanpek • Negotin	90

District	Seat	Area in km2	Population in 2011	Population per km2	Municipalities & cities	Settlements
Braničevo District (Braničevski okrug)	Požarevac	3,865	180,480	46.7	• Veliko Gradište • City of Požarevac • Golubac • Malo Crniće • Žabari • Petrovac • Kučevo • Žagubica	189
Jablanica District (Jablanički okrug)	Leskovac	2,769	215,463	77.8	• City of Leskovac • Bojnik • Lebane • Medveđa • Vlasotince • Crna Trava	336
Nišava District (Nišavski okrug)	Niš	2,729	373,404	136.8	• Aleksinac • Svrljig • Merošina • Ražanj • Doljevac • Gadžin Han • City of Niš	285
Pčinja District (Pčinjski okrug)	Vranje	3,520	158,717	45.1	• Vladičin Han • Surdulica • Bosilegrad • Trgovište • City of Vranje • Bujanovac • Preševo	363
Pirot District (Pirotski okrug)	Pirot	2,761	92,277	33.4	• Bela Palanka • City of Pirot • Babušnica • Dimitrovgrad	214
Podunavlje District (Podunavski	Smederevo	1,248	198,184	158.8	• City of Smederevo • Smederevska Palanka • Velika Plana	58

District	Seat	Area in km2	Population in 2011	Population per km2	Municipalities & cities	Settlements
okrug)						
Toplica District (Toplički okrug)	Prokuplje	2,231	90,600	40.6	• City of Prokuplje • Blace • Kuršumlija • Žitorađa	267
Zaječar District (Zaječarski okrug)	Zaječar	3,623	118,295	32.6	• Boljevac • Knjaževac • City of Zaječar • Sokobanja	173

Vojvodina

District	Seat	Area in km2	Population in 2011	Population per km2	Municipalities & cities	Settlements
Central Banat District (Srednjebanatski okrug)	Zrenjanin	3,256	186,851	57.4	• Novi Bečej • Nova Crnja • Žitište • Sečanj • City of Zrenjanin	55
North Bačka District (Severnobački okrug)	Subotica	1,784	185,552	104.0	• City of Subotica • Bačka Topola • Mali Iđoš	45
North Banat District (Severnobanatski okrug)	Kikinda	2,329	146,690	63.0	• Kanjiža • Senta • Ada • Čoka • Novi Kneževac	50

District	Seat	Area in km2	Population in 2011	Population per km2	Municipalities & cities	Settlements
					• City of Kikinda	
South Bačka District (Južnobački okrug)	Novi Sad	4,016	615,371	151.3	• Srbobran • Bač • Bečej • Vrbas • Bačka Palanka • Bački Petrovac • Žabalj • Titel • Temerin • Beočin • Sremski Karlovci • City of Novi Sad	77
South Banat District (Južnobanatski okrug)	Pančevo	4,245	291,327	68.6	• Plandište • Opovo • Kovačica • Alibunar • City of Vršac • Bela Crkva • City of Pančevo • Kovin	94
Srem District (Sremski okrug)	Sremska Mitrovica	3,486	311,053	89.2	• Šid • Inđija • City of Sremska Mitrovica • Irig • Ruma • Stara Pazova • Pećinci	109
West Bačka District (Zapadnobački okrug)	Sombor	2,420	187,581	77.5	• City of Sombor • Apatin • Odžaci • Kula	37

3.5.7.2 Permanent Population and Housing

According to official data from the 2011 Census, the Republic of Serbia had 7.186.862 inhabitants living in 2.487.886 households.

Approximate forecasts of the total population in the Republic of Serbia for 2035 amount 7.428.944 inhabitants (expected scenario), or 7.908.593 inhabitants (optimistic scenario). These demographic future scenarios are the result of adding up two methodologically different sources of projections due to the lack of a single source of demographic data for the entire territory of the Republic of Serbia. Therefore, when interpreting the projected numbers for the level of the Republic, this important limitation should be taken into account.

The purely analytical “no migration” scenario, which shows what the population dynamics of Serbia would look like until 2035 solely under the influence of births and deaths, refers only to the population in Central Serbia and Vojvodina and amounts to 6,069,622 inhabitants, because the projection does not include such an analysis.

3.5.7.3 Economy

Serbia’s development has accelerated notably since the year 2000. Income per capita has more than doubled, poverty has fallen rapidly, and the country has established itself as a competitive, export-led market economy despite successive crises. Economic growth averaged 6.5% per year between 2001 and 2008, and trade grew from 57% to 79% of GDP. However, growth in this period was unbalanced; the employment rate fell during the decade as external imbalances mounted. Serbia was highly exposed to the 2008-09 global financial crisis and suffered recessions not only in 2009, but also in 2012 – due to severe weather conditions and contagion from the 2011 Eurozone crisis – and in 2014 due to particularly severe floods. Following fiscal consolidation since 2014 and a steady recovery of foreign direct investment (FDI) flows, the economy was on track to recover economic dynamism by 2019, with growth reaching 4.2%. Despite the turmoil, trade grew from 77% to 113% of GDP between 2010 and 2019. By the end of 2019, unemployment had fallen below 10% for the first time since the 1990s.[25]. After a relatively mild contraction in 2020, the Serbian economy rebounded strongly in 2021 followed by some deceleration in the first half of 2022. After decreasing in 2020, external imbalances started to widen in the second half of 2021, in particular due to high energy imports. Consumer price inflation surged in the second half of 2021, mostly driven by energy and food prices, which led the central bank to start tightening its policy stance. Banking sector stability was preserved and lending growth remained robust despite the phasing-out of liquidity-enhancing measures. The economic rebound and the reduction of fiscal support measures helped to substantially improve the budget balance in 2021, despite a further increase in capital spending. A slight increase in the unemployment rate in 2021 reflected in particular a rising labour market participation as part of the rebound from the COVID-19 crisis[26].

[25] https://www.oecd-ilibrary.org/sites/17b76123-en/index.html?itemId=/content/component/17b76123-en
[26] https://ec.europa.eu/commission/presscorner/detail/en/country_22_6089

Key economic figures regarding Serbia's economy are presented below[27]:

Table 4.1: **Serbia - Key economic figures**	**2013-18** average	**2019**	**2020**	**2021**
GDP per capita (% of EU-27 in PPS)[1)]	40	41	43	44
Real GDP growth	2.2	4.3	-0.9	7.4
Economic activity rate of the population aged 15-64 (%), total[1)]	65.0	66.9	66.4	70.3
female	*57.0*	*59.7*	*59.2*	*63.0*
male	*73.0*	*74.0*	*73.6*	*77.5*
Unemployment rate of the population aged 15-64 (%), total[1)]	17.4	10.9	9.5	11.4
female	*18.4*	*11.5*	*9.9*	*12.4*
male	*16.6*	*10.4*	*9.2*	*10.6*
Employment of the population aged 15-64 (annual growth %)	4.0	2.4	-0.2	2.6
Nominal wages (annual growth %)	3.1	10.5	9.4	9.4
Consumer price index (annual growth %)	2.9	1.8	1.6	4.1
Exchange rate against EUR	119.0	117.9	117.6	117.6
Current account balance (% of GDP)	-4.6	-6.9	-4.1	-4.4
Net foreign direct investment, FDI (% of GDP)	5.1	7.7	6.3	6.8
General government balance (% of GDP)	-2.4	-0.2	-8.0	-4.1
General government debt (% of GDP)	63.0	52.8	57.8	57.1

Notes:
1) Eurostat
Source: national sources

Serbia's strongest sectors are energy, the automotive industry, machinery, mining, and agriculture. Primary industrial exports are automobiles, base metals, furniture, food processing, machinery, chemicals, sugar, tires, clothes, pharmaceuticals. Trade plays a major role in Serbia's economic output. Serbia is in the gradual process of accession to the EU and receives substantial EU development funds. Serbia's main trading partners are Germany, Italy, China, and Russia. Despite its relatively small size, Serbia's emerging economy represents significant opportunities for exports and investments across a wide range of sectors, particularly infrastructure, ICT, healthcare, agribusiness, energy, and environmental technologies.[28]

An overview of some of the key sectors is presented in the following section. Detailed information on the energy sector is already presented in detail throughout the SEA report and is not repeated here.

3.5.7.3.1 Agriculture

The agriculture sector in Serbia accounts for 10 % of GDP, but in recent years it has recorded significant losses, primarily due to the intensification of dry periods. So, for example, in 2012, losses of 2 billion dollars were recorded due to drought. There are several causes behind these

[27] https://neighbourhood-enlargement.ec.europa.eu/system/files/2022-10/Serbia%20Report%202022.pdf
[28] https://www.trade.gov/country-commercial-guides/serbia-market-overview

losses. First, the combination of high temperatures and more intense solar radiation causes damage to plants (fruits, for example), which reduces the yield. Second, high temperatures allow the development of pathogens suited to warmer conditions, which attack crops. Third, due to the lack of irrigation on large areas, crops depend on natural rainfall, which is increasingly variable due to climate change. Therefore, longer periods without rain are threatening the harvest.

If 1991 is taken as the base year in which the yields were satisfactory, then between 1994 and 2014 there were serious yield losses of wheat between 1 and 40 %, sugar beet 1-47 %, corn 1-60 %, soybeans 1-54 %, alfalfa and clover up to 35 %, beans 55-70 %, potatoes over 40 %. This reduction in yield also has effects on the consumer prices of these products, so, for example, due to the reduction in the yield of beans, their price increased from 27 dinars per kilo in 1999 to 260 dinars per kilo in 2012.

In addition to consumers, these losses also affect agricultural producers: the damage assessment of the aforementioned crops for the period 1994-2014 on a sample covering 43 % of cultivated areas, amounts to 4.6 billion dollars. A worrying fact is that the corn crop, which is of special importance for Serbian agriculture, is the most affected by climate change: the losses of this crop alone amount to 2.2 billion dollars. To make the situation even worse, the models predict a further decrease in corn yields, by 6 % by 2030, but between 22 % and 55 % by the end of the century. On the other hand, the yield of wheat by the end of the century will be 10 % lower only in the south of Serbia. Climatic changes in Serbia will therefore have a significant impact on the quality and quantity of yields, but also on differences in yields between one year and another.

3.5.7.3.2 Automotive industry

Over the past years, Serbia was one of leading European destinations for foreign investments in the automotive industry. Currently the major product groups in Serbian automotive industry are: Tires, Wiring harness, Wipers, Hoses, Various metal components. Given the current investment trends, these will be replaced in the future by products such as electric motors, turbochargers, radar and optical sensors, electronics and power converters.

3.5.7.3.3 Telecommunications and IT industry

Serbia generates 10 percent of its GDP from the ICT sector, among the top four export sectors, along with steel, cars, and agriculture. According to Serbia’s Statistics Office, there were over 3,354 firms in Serbia’s tech sector in Q1 2022 employing 47,609 people. Serbian tech companies produce software for industries ranging from agriculture to medicine, as well as tracking and cloud applications, online games, and testing. They also run call centres and customer helplines, ranging from low-skilled to very high-tech.

3.5.8 Human Health

In recent years, the Republic of Serbia is increasingly facing risks to human health that are directly or indirectly related to climate change. Direct effects can occur due to temperature rise, climate variability, increased intensity of precipitation, longer duration of droughts.

For example, during the heat wave in July 2007, 167 more human victims were registered compared to the same period in previous years (90 % were people over 75 years old) and it was determined that if the average daily temperature rises above 90, 95th and 99th percentiles, the average number of deaths will increase by 15.3 %, 22.4 % and 32.0 %.

Like heat waves, floods have a direct effect on human health, which citizens witnessed when several people lost their lives during the May 2014 floods. Indirect risk to health occurred during the aforementioned floods during the contamination of surface and underground water and the surrounding soil with dangerous substances and wastewater, but also as a result of damage to health facilities in 15 municipalities.

An indirect threat to health from climate change is also found in infectious diseases that spread through vectors such as mosquitoes (West Nile virus, malaria, etc.), or through water (cholera, diarrhoea, etc.). In recent years, for example, there has been an increase in West Nile virus infections: 302 cases in 2013 compared to 71 cases in 2012. Predictions for the future speak of the possible spread of vector-borne infectious diseases due to changing climate conditions, which become more favourable for the development of vectors that transmit these infections.

3.5.9 Infrastructure

3.5.9.1 Transport

Due to its strategic position in the heart of Southeast Europe, Serbia is often referred to as a gateway to Western Europe. Serbia is home to three important European transport corridors: VII (the River Danube), X (the international highway and railroad), and XI (connecting Central Europe and the Adriatic Sea), providing excellent connections with Western Europe and the Middle East.

Underfunding is a longstanding problem. The government has begun to address that in a significant building boom in recent years using grants, loans, and its strong fiscal position, most notably in highways, but much work remains. In December 2019, the government announced the new National Investment Plan, allocating approximately $14 billion for major development projects to be completed by 2025. A large portion of the funds will go to infrastructure projects, including road, rail, air, and water upgrades.

3.5.9.2 Roads

Serbia's road network is 45,220 km long, of which 952.7 km are toll highways. It also includes 2,960 bridges and 85 tunnels. According to the Serbian Ministry of Infrastructure, about 1,000 km of fast roads are currently being designed and built in Serbia

3.5.9.3 Railway

Transport of goods via railroad is cost-effective, and through Pan European Corridors X and VII, Serbia offers access to all European destinations. As in many countries, Serbia's railway system suffered due to lack of investments in previous years, but the country has made serious efforts to restructure and modernize it. A new high-speed railway from Belgrade to Novi Sad started operating as of March 2022. Since the liberalization of Serbian railroad transportation in 2016, Serbian Railways has signed contracts with 43 international forwarding companies, and "shuttle" container trains have started using Serbian railways for pan-European transport. The maximum spindle capacity of the Serbian rail system is 22.5 metric tons. The priority now is the development of multimodal transportation (transition from road to railway and river transportation).

3.5.9.4 Air

Serbia can be reached by air through its two international airports: Belgrade's Nikola Tesla Airport and Nis International Airport. Airport Morava near Kraljevo in central Serbia opened in 2019 and has not established a regular flight schedule, in part due to the COVID-19 pandemic, but is expected to become Serbia's third international airport. An airport in Vrsac is currently being used only for domestic non-commercial flights and training and leisure aviation but is expected to soon be granted an international certification. Transportation by air to and from Belgrade is possible to almost every destination in the world, either directly or by layover. In 2016, national carrier Air Serbia introduced direct flights to New York City.

Serbia owns 92 percent, and Montenegro owns eight percent, of the Serbia and Montenegro Air Traffic Security Agency (SMATSA), which controls air traffic over Serbia, Montenegro, part of the Adriatic Sea, and 55 percent of the upper airspace over Bosnia and Herzegovina.

In March 2018, the Serbian government awarded a 25-year concession for Belgrade's international airport to France's operator, Vinci. The firm committed to finance, develop, and manage the airport's infrastructure, and to operate the airport itself. Vinci is investing several hundred million euros to boost the airport's capacities from between five and seven million to at least 17 million passengers per year.

3.5.9.5 Waterways

Serbia's river corridors offer 959 km of excellent, cost-effective transportation routes. The Danube (588 km) represents the most reliable year-round navigable route. Artificial canals supplement this to form the Rhine-Main-Danube international canal, which allows barge traffic between the North Sea and the Black Sea, and Danube-Tisa-Danube, together offering a network of routes that provide access to all Danube-basin countries. The Sava River links Slovenia, Croatia, Bosnia & Herzegovina, and Serbia, and is in the process of gaining the status of International Navigable Route.

3.5.9.6 Water Supply and Sanitation Network and Wastewater Management

Regarding the technical conditions of water supply and sewerage netwotk, the situation is not at a satisfactory level, although the number of new connections to public water supply and sewerage is increasing.

The percentage of residents connected to the public water supply is constantly growing, so that the connection from 65 % in 2000 to 2018 increased by 24.9 % when it is 89,9 %, which will provide drinking and production water to a larger number of the population and the economy of the settlement which meets the requirements regarding health fitness.

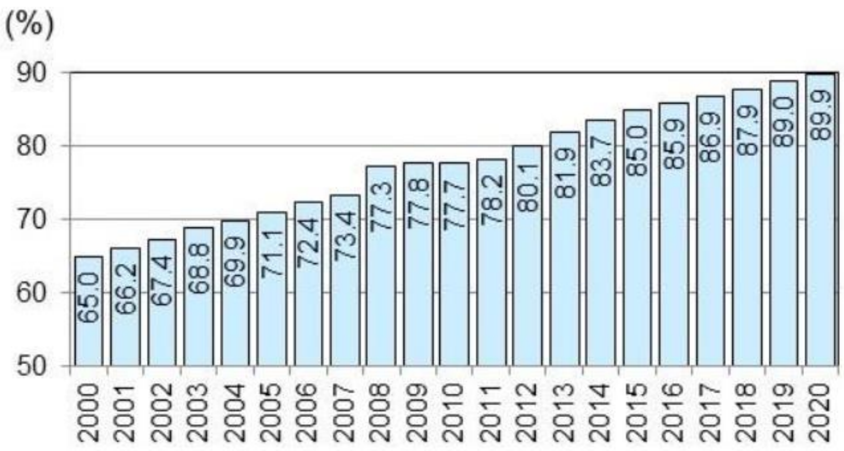


Figure 3.46: **Percentage of inhabitants connected to public water supply (2000-2020)**

Within the National Register of Pollution Sources, data related to polluted (untreated) wastewater is monitored. The indicator monitors the share of discharged untreated wastewater into surface water bodies in relation to the total amount of discharged wastewater.

According to multi-year data, the amount of total wastewater in the period 2008-2018 has a decreasing trend. Looking at the regions, the most untreated wastewater (95-100 %) is in Nišavska, Beogradska, Zlatiborska, Borska, Rasinska, Pirotska, Toplička, Braničevska and

Sremska regions. The least number of them are in Podunavska (24 %), Severnobačka (28.6 %), Šumadija (29.7 %), Severnobanatska (40.4 %) and Kolubarska (45.4 %) regions.

The highest percentage of the population connected to the public water supply is in Zapadnobačka, Severnobanatska, Južnobanatska, Srednjebanatska, Sremska and Zaječarska oblasts, where 100% of the population is connected. The lowest percentage is in the Nišavska (52.1%) and Toplička (69.8%) areas.

Figure 3.47: Percentage of residents connected to the public water supply system by district (2019)[29]

The percentage of residents connected to public sewerage is constantly growing in the period 2000-2020. Access from 40.2% in 2000 has increased by 25.7% by 2020 and will be 65.9% in 2020, which will improve living conditions and provide a healthier environment for a greater number of the population and the economy of the settlement.

The population that is not connected to the public sewage system mostly uses septic tanks to evacuate their wastewater, while a smaller part uses dry systems and non-purpose installations for the evacuation of wastewater. There is a significant difference in the degree of connection of the population to the sewage system compared to the connection to the water supply,

[29] Data source: Republic Institute of Statistics

especially in settlements with less than 50,000 inhabitants, which represents a special danger of groundwater pollution.

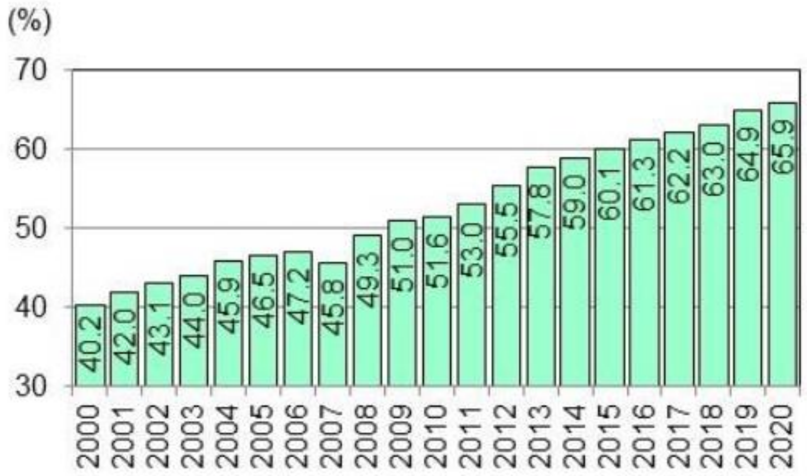


Figure 3.48:Percentage of inhabitants connected to public sewage (2000-2020)

The highest percentage of the population connected to public sewerage is in Belgrade (86.1 %) and Šumadijska area (77 %), while the lowest percentage is in Zapadnobačka (32 %) and Nišavska (34.7 %) areas, where residents are mostly connected to septic tanks.

Figure 3.49:Percentage of inhabitants connected to public sewage by regions (2020)

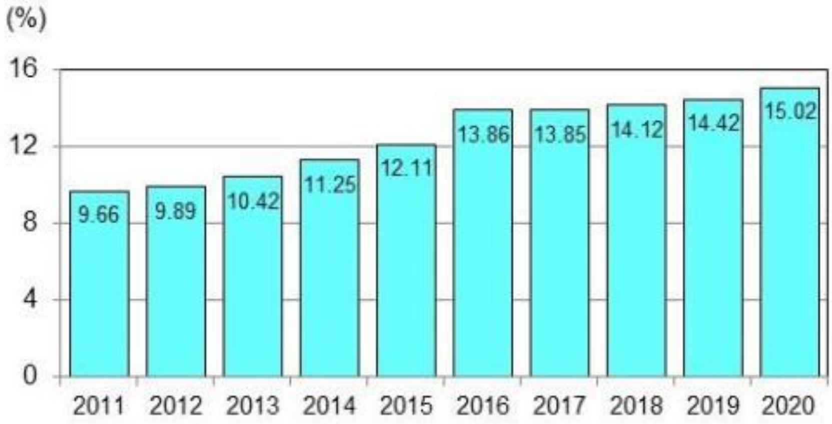


Figure 3.50: The percentage of the population trained in wastewater treatment (2011-2022)

The percentage of the population trained in wastewater treatment is constantly growing in the period 2011-2020. In 2020, it reached a maximum of 15.02% and compared to 2011, it increased by 5.36% (Figure 3.52).

The percentage of the population trained in wastewater treatment, depending on the type of treatment, also has a favourable (growing) trend in the period 2011-2020. for secondary and tertiary treatment, while for primary treatment the trend is insignificant. In the period 2016-2020 tertiary treatment as the most perfect purification treatment has grown significantly in 2020 and 4.1% of the population is connected to this treatment in 2020. This type of wastewater treatment is 2.85% higher in 2020 compared to 2011 (Figure 3.52).

Figure 3.51: Quantities of wastewater in the Republic of Serbia (2011-2020)

Severnobačka region has the most treated wastewater by all types of treatment, discharged into wastewater disposal systems in 2020 (96.6%). Central Banat, Belgrade, Braničevska, Jablanička, Zlatiborska, Toplička and Nišava regions have no treated waste in the same period (Figure 3.52).

Figure 3.52: Percentage of the population trained in wastewater treatment depending on the type of treatment in the Republic of Serbia (2011-2020)

The analysis of pollutant discharges in municipal and industrial wastewater is performed based on the amount of **total nitrogen** and **total phosphorus**.

The annual amount of pollutant emissions is calculated using the concentration pollutants in (mg/l) and the volume of discharged wastewater per year in (m^3/year).

Pollutant emissions from industrial sewage systems are shown in summary.

Figure 3.53: Overview of emitted amounts of nitrogen (N) and phosphorus (P) in waste municipal and industrial waters by year in the Republic of Serbia.

Based on the received data, an analysis was performed on the balance of emissions of polluting substances, and the amounts of total nitrogen and total phosphorus in municipal and industrial wastewater were presented. In contrast to 2017, when the total emission of nitrogen and phosphorus was slightly increased, the total emission of nitrogen was approximately the same in the last year, while a favourable (declining) trend was recorded for the total emission of phosphorus, which continues in 2021.

The emitted amounts of total nitrogen for 2021 amount to 13,152,075 t.

The emitted amounts of total phosphorus for 2021 amount to 1,235,231 t.

For the reporting year 2021, 156 wastewater treatment facilities submitted adequate reports and 69 JK companies sent data on wastewater.

By processing the submitted data, it can be concluded that the largest emitted amounts of nitrogen and phosphorus in waste industrial waters come from plants within the energy sector and from PU companies that manage waste and wastewater at the municipal level (Figure 3.54 and Figure 3.55).

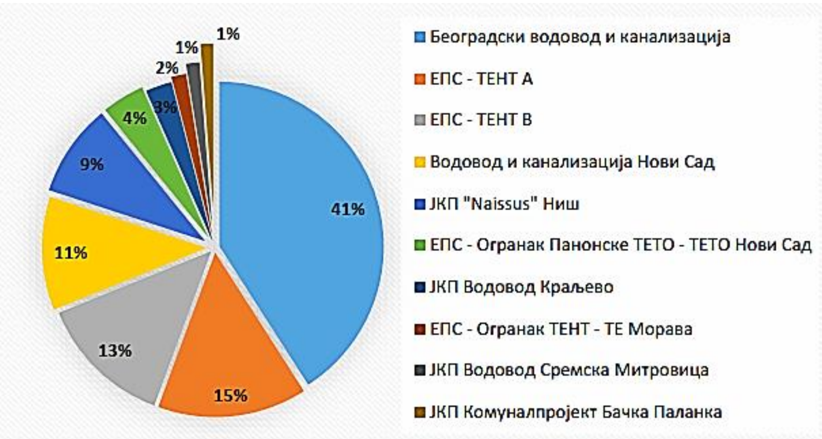


Figure 3.54: **The largest sources of nitrogen pollution in the Republic of Serbia in 2021**

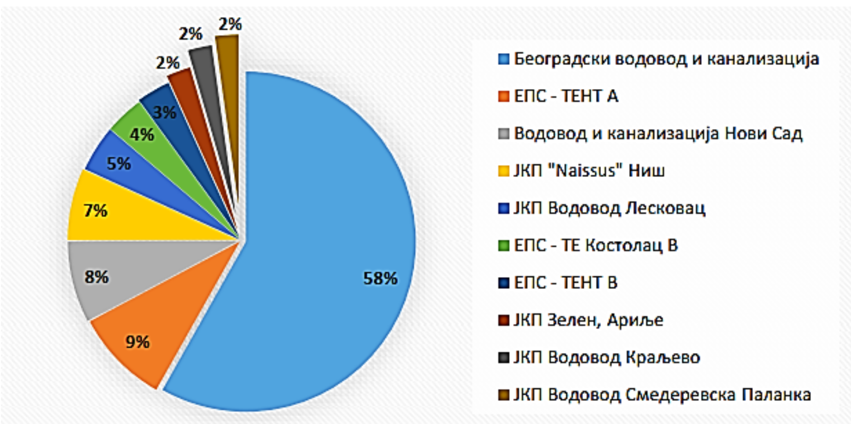


Figure 3.55: The largest sources of phosphorus emission pollution in 2021[30]

Percentage of population covered by wastewater treatment is constantly growing in the period 2010-2019. In 2019, it amounts to a maximum of 14.42 % and compared to 2010, it increased by 5.06 % (Figure 3.56).

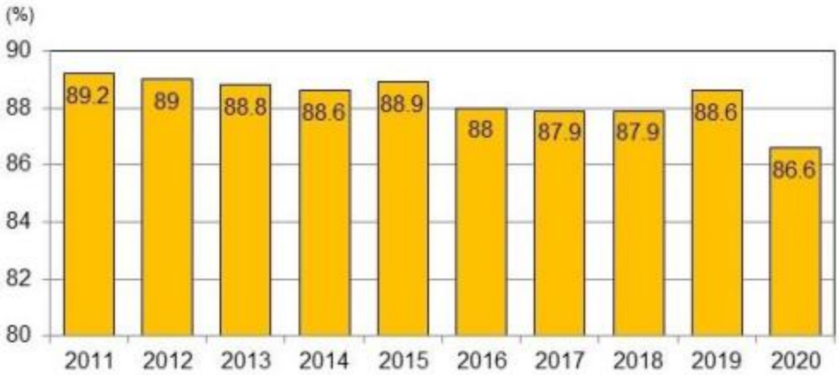


Figure 3.56: Percentage of population covered by wastewater treatment in the Republic of Serbia (2011-2020)

Amount of total wastewater in the period 2011-2020 have an insignificant trend. The average amount of polluted (untreated) wastewater in the same period was 365.9 million (m3/year) (88.4% of the total wastewater) and also has an insignificant trend.

The average amount of treated wastewater in the same period is 11.6% of the total wastewater and has an insignificant trend (Figure 3.57).

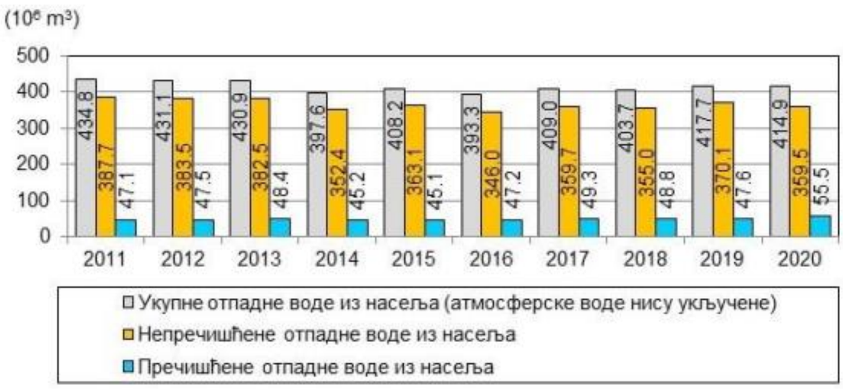


Figure 3.57: Amounts of total wastewater in the period 2011-2020

3.5.9.7 Solid waste management

Waste management in the Republic of Serbia is defined by a series of regulations, the most significant of which is the Law on Waste Management ("Official Gazette of RS", 36/09, 88/10,

[30] Data source: Environmental Protection Agency

14/16 and 95/18 – other law) and the Law on Packaging and Packaging Waste ("Official Gazette of RS", no. 36/09 and 95/18 – other law).

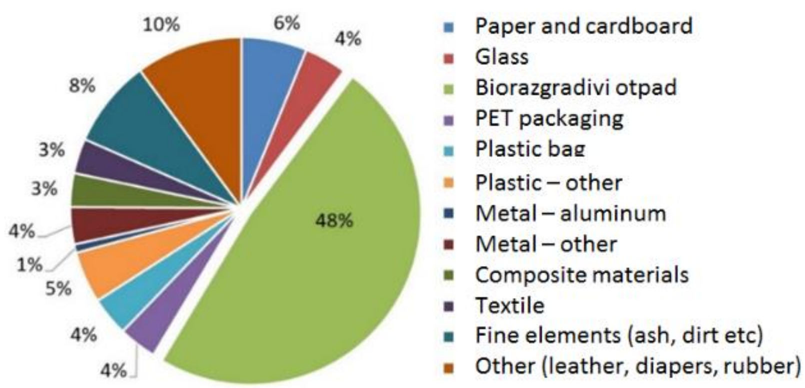
Table 3.16: Indicators related to municipal waste[31] *

	2017	2018	2019	2020 *
Total amount of municipal waste generated (mil.t)	2.71	2.77	2.80	2.92
Recycled fractions of municipal waste (mil.t)	0.283	0.330	0.334	0.343
Exported municipal waste fractions (mil.t)	0.098	0.096	0.109	0.114
Amount of collected and deposited waste (mil.t)	2.33	2.34	2.36	2.46
Average scope of waste collection (%)	83.7	87.2	86.2	86.4
Average daily amount of municipal waste per inhabitant (kg)	1.07	1.10	1.11	1.15
The degree of municipal waste recycling	14.1	15.4	15.8	15.7

* Estimate based on the number of inhabitants in 2019

Data on municipal waste are provided by public utility companies from local communities. In 2020, reports were submitted by 102 PUCs. An increase in the amount of generated and collected municipal waste can be seen in the figure below.

The composition of municipal waste in 2020 (Figure 3.58) indicates the largest representation of biodegradable waste in the proportion of 48.4 %. Types of waste that are significantly smaller represented are: paper and cardboard, fine elements and others (leather, diapers, rubber, etc.).



[31] Source: Report on the state of the environment in the Republic of Serbia, Ministry of Environmental Protection, ENVIRONMENTAL PROTECTION AGENCY, Belgrade 2021

Figure 3.58: **Composition of municipal waste in 2020**

In the Republic of Serbia, 12 sanitary landfills have been built so far, of which ten are regional and two are local. Table 3.17 shows the amount of waste deposited in sanitary landfills in 2021.

Table 3.17: Amounts of disposed waste at sanitary landfills

	Sanitary landfill	2021
1.	“Duboko” Užice	87.905
2.	“Vrbak” Lapovo	50.404
3.	“Kikinda” Kikinda	29.717
4.	“Gigoš” Jagodina	75.835
5.	“Željkovac – D 2 “ Leskovac	77.388
6.	“Muntina padina” Pirot	33.918
7.	“Jarak” Sremska Mitrovica	58.574
8.	“Pancevo” Pancevo	41.817
9.	“Subotica” Subotica	27.978
10.	“Meteris” Vranje	23.504
11.	“Vujan” Gornji Milanovac	15.095
12.	Vinča Belgrade	327.980
	total:	850.115

Business entities report to the Environmental Protection Agency about the waste they produce in the course of their activities and how they are treated. Based on received reports, 8.88 million tons of waste were produced in the Republic of Serbia in 2021. Of that, approximately 60,000 t is hazardous waste.

5,000 plants submitted data on the waste they generate during their activities and how they are treated, which is significantly more than the number of plants that submitted annual reports for 2020, but the amount of waste produced during the company's activities is less compared to the previous year.

Thermal energy facilities are the biggest producers of waste. Fly ash from coal and ash, slag and dust from the boiler, which are labelled 10 01 in the Waste Catalog, were generated in the amount of 7.04 million tons, that is, they make up 79% of the total amount of produced waste.

The amount of coal fly ash produced is 700,000 tons less than the previous year, which explains the reduced total amount of waste produced. Other types of waste originating from the thermal process are represented in significant quantities: unprocessed slag and waste from slag processing from the iron and steel industry, calcium-based solid waste generated in the gas desulfurization process. This is followed in terms of quantity by solidified and other wastes from waste treatment plants, excavation and soil generated during construction activities, glass, plastic and wood containing hazardous substances and sludge from washing, cleaning, peeling, centrifugation and separation.

Table 3.18 shows the amount of waste produced during the company's activity according to origin for the year 2021, based on the received reports that were submitted through the Agency's information system until May 15, 2022. In accordance with the Law, the Agency does not collect data on the amount of group 01 waste that is generated in research, excavations from mines or quarries, and physical and chemical treatment, so the table does not show these types of waste. The amounts of waste produced in households are not included either.

Table 3.18: Recorded quantities of produced waste according to origin without municipal waste household waste

Group	Activities generating waste	Amount of non-hazardous waste (t)	Amount of hazardous waste (t)
01	Mining	/	/
02	Agriculture and food preparation	129.932	0,3
03	Wood industry, paper, cardboard	47.942	/
04	Leather, fur and textile industry	10.870	/
05	Oil processing, natural gas and coal treatment	/	1.851
06	Inorganic chemical industry	135	1.193
07	Organic chemical industry	9.320	426
08	Coatings, adhesives, sealants and printing inks	1.461	1.225
09	Photography industry	132	114
10	Waste from thermal processes	7.701.168	9.944
11	Protection of metals and other materials	1.198	1.445
12	Molding and surface treatment of metals and plastics	64.960	746
13	Waste oils and residues of liquid fuels	/	6.234

Group	Activities generating waste	Amount of non-hazardous waste (t)	Amount of hazardous waste (t)
14	Waste organic solvents, cooling agents	/	15
15	Packaging waste, absorbents, wiping cloths	153.806	3.944
16	Waste not otherwise specified in the catalog	45.243	13.589
17	Construction waste and demolition waste	231.983	8.332
18	Health protection of people and animals	406	4.574
19	Waste from waste treatment plants	321.392	2.440
20	Municipal and similar waste	101.711	3.264
	In total	8.821.659	59.336

The difference between the amount produced and the amount of waste that was handed over for further treatment represents the amount of waste that remained in the warehouse at the waste producer.

Out of the total amount of waste produced, the method of handling was reported for 1.881.445 t (21%), while 6.999.550 t (79%) remained at the locations where the waste was produced, which is mostly coal fly ash. Waste from slag processing from the iron industry and steel represent the largest amounts of disposed waste and waste subjected to recycling utilization. Of the exported quantities of non-hazardous waste, metals containing iron are the most represented.

When talking only about hazardous waste, the method of handling was reported for 47.249 t, respectively 80 %. The largest share of the amount of hazardous waste disposed of consists of sludge and filter cakes from gas treatment containing hazardous substances. Significant quantities of hazardous waste submitted to treatment by reuse is represented by waste containing oil and separately collected electrolyte from batteries and accumulators. Hazardous components removed from discarded equipment, cleaning acids and slag from thermal lead metallurgy represent the largest amounts of hazardous waste that was exported.

Table 3.19: Method of management with produced waste

Nature waste	Produced (t)	Handed over to another company for temporary storage (t)	Handed over to disposal (t)	Handed over for reuse (t)	Export (t)	Left at the producers storage (t)
Dangerous	59.336	11.547	7.187	25.370	3.145	12.087
Not dangerous	8.821.659	324.984	349.915	1.109.94	49.354	6.987.463

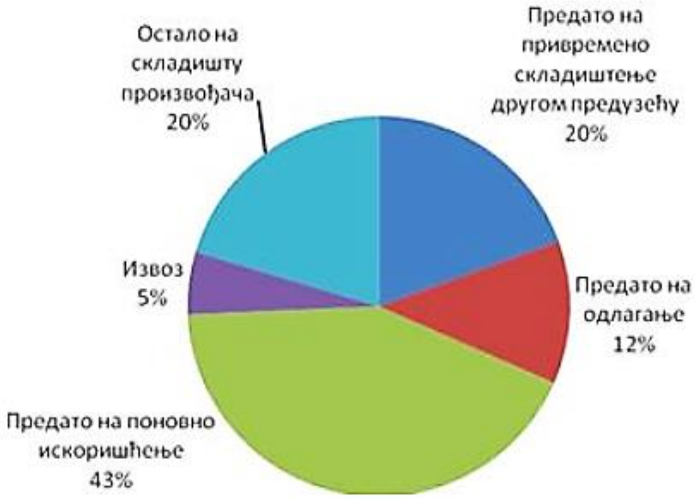


Figure 3.59: Method of management with produced hazardous waste[32]

3.5.9.8 Energy

Thermal power plants and hydroelectric power plants are the main production capacities in Serbia. Total installed capacity for electricity production in the Republic of Serbia is 8.51 GW[33].

The main entity in Serbia for the production of electricity is the state company JP "Elektroprivreda Srbije", which has 22 thermo-blocks, 49 hydro aggregates, 1 reversible hydroelectric power plant with 2 aggregates and 1 pumping station with 2 pumps:

- 9 TPP and TPP-HP capacity 4,368 MW
- 16 HPP power 2,958 MW*

Coal consumption is predominantly related to energy production through transformation (about 92%), of which the largest consumption is in thermal power plants.

[32] Data source: Environmental Protection Agency

[33] AERS, 2021 Energy Agency Report, 2021

The structure of production capacities is shown in the following figure. The power share of thermal power plants (TPP, that is TE) and thermal power plants - heating plants (TPP-HP, that is TE-TO) is 52 %, hydroelectric power plants (HPP, that is HE) connected to the transmission system 34.5 % (one of which is a reversible HPP with a capacity of 2x307 MW, which, apart from having a significant energy share, is also very important for system management), the share of wind power plants connected to the transmission system is 4.4 % and 2.9 % of the installed capacities are small power plants connected to the distribution system.

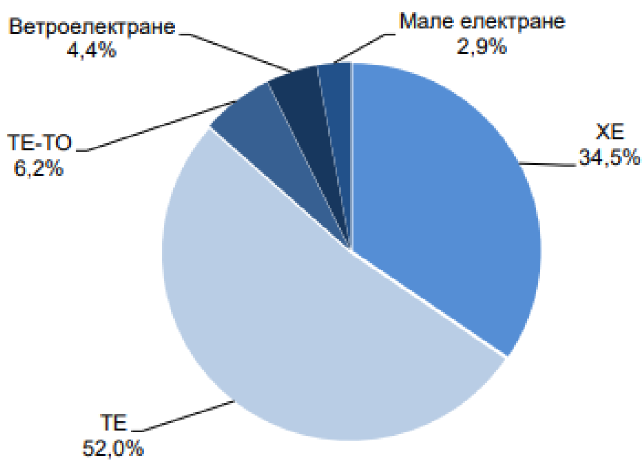


Figure 3.60: Structure of production capacities in 2021

(Source: Report on the work of the Energy Agency for 2021)

Electricity prices in Serbia are lower than in the wider region. Considering the concept of opening the electricity market, in accordance with the provisions of the contract establishing the Energy Community, it can be expected that, when this market begins to function at full capacity, electricity prices will be at the level of prices in neighbouring countries.

The below figure gives an overview of energy facilities in Serbia.

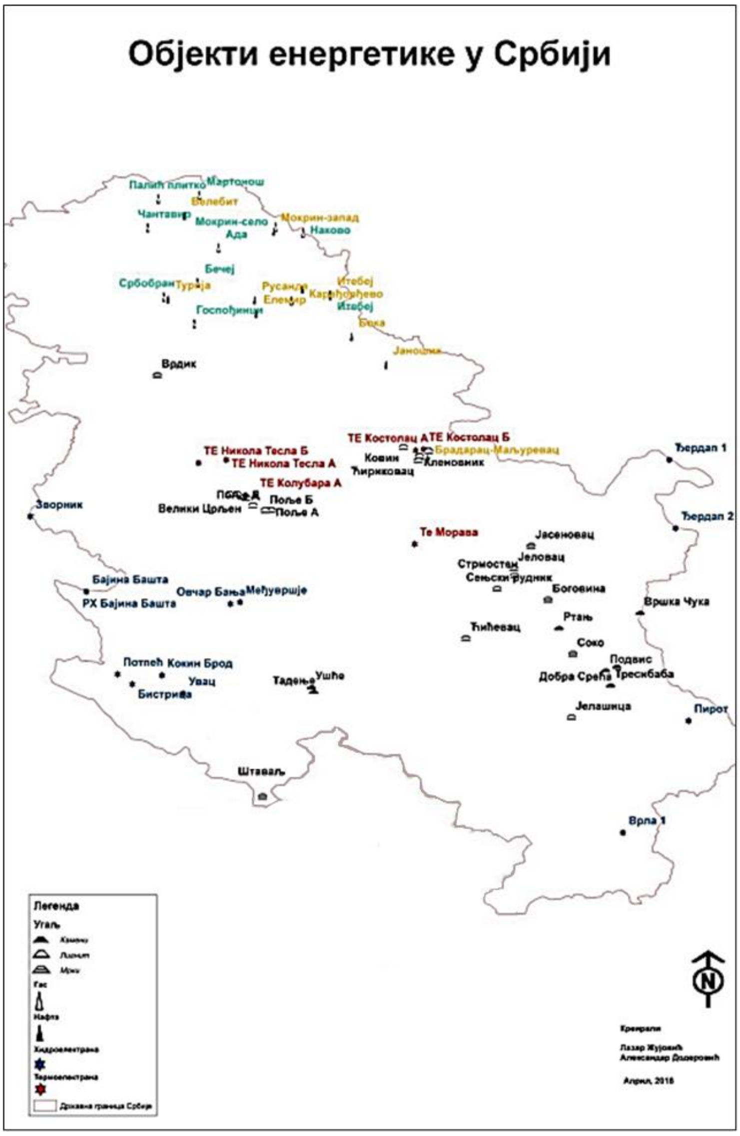


Figure 3.61: Display of energy facilities[34]

INECP foresees the construction of new capacities: TPP Kostolac B3 350 MW, new wind farms 1,770 MW by 2030, new solar plants 1,729 MW by 2030, as well as interconnections Serbia - Bulgaria, Serbia - Romania (2025 Pančevo - Rešica and 2029 Đerdap 1 - Portile De Fier), Serbia - Bosnia and Herzegovina (2027), Serbia - Montenegro (2024 and 2027), Serbia - Croatia in 2027, and the interconnection with Hungary by 2028.

[34] Source: Aleksandar Doderović, Lazar Žujović : CREATION OF THE THEMATIC MAP OF MINES IN SERBIA USING THE PROGRAM ARCMAP, GIS Journal 1/2016

3.5.9.8.1 Energy resource potential

Regarding the resource potential the situation is as follows:

Coal

The most important coal deposits in the Republic of Serbia are lignite deposits. Geological reserves of lignite in relation to geological reserves of all types of coal in the Republic of Serbia make up 97 %. Exploitable coal reserves with a high degree of exploration, which are divided by profitability into the class of balance coal reserves profitable for exploitation and the class of off-balance sheet coal reserves which at the moment are not profitable for exploitation, are 8.88 billion tons, while about 4 billion tons in the central part of the Republic of Serbia, i.e., in the Kolubara and Kostolac basins.

Oil and natural gas

The basic characteristics of the state of resources and reserves of oil and natural gas in the Republic of Serbia are the small volume of conventional resources and balance reserves, a relatively high degree of exploration and the limitation of the exploration area. In most oil and gas deposits, a relatively high degree of utilization was achieved, which caused a drop in production. With the application of new technologies and interventions at the wells, the decline in production was temporarily stopped.

The remaining crude oil balance reserves in the Republic of Serbia amounted to about 10.14 million tons, or 4.23 billion m^3 of natural gas.

These reserves are of low exploitable quality (mature and late stage of exploitation of existing deposits), which requires the application of new development and production technologies.

Only after the completion of detailed geological research in the area of central, eastern and south-eastern Serbia, it will be possible to speak more precisely about possible potentials from the aspect of oil and gas reserves.

The Pannonian Basin, although young in geological terms, is defined as one of the potential basins in Europe for unconventional hydrocarbon resources. In this sense, a project of geological research of unconventional gas was started, and after its completion, the potentials of our part of the Pannonian Basin, when it comes to unconventional sources of hydrocarbons, will be more precise.

Oil and natural gas reserves are modest. Their further exploitation will depend on the translation of off-balance reserves into on-balance reserves, as well as the discovery of new deposits.

The Republic of Serbia is currently import dependent when it comes to oil, oil products and natural gas.

Oil shales

Oil shales reserves in the Republic of Serbia have been determined in the following basins: Aleksinački, Vranjski, Senonski tektonski trench, Valjevsko-Miončki, Zapadnomoravski, Kruševački, Babušnički, Kosanički, Niški and Levački. Apart from Aleksinački, the other basins have not been sufficiently explored, and the total estimated reserves in the listed basins are 4.8 billion tons of shales, that is, about 400 million tons of kerogen.

Potential reserves of oil shale in the Aleksinac deposit are estimated at around 2 billion tons. Only the Dubrava field with an average content of organic matter of 16.6 vol % and an oil yield of 8.95 mas % was investigated in detail. According to the dominant type of kerogen and the degree of conversion, the kerogen reserves of the Aleksinački Basin are estimated at around 200 million tons.

The reserves of oil shales are significant, but the conditions of their exploitation and the technology of their use have yet to be defined, given that it is an unconventional fuel and significant problems related to environmental protection.

Nuclear raw materials

The Republic of Serbia does not have balance reserves of nuclear raw materials. Geological reserves of uranium ore amount to about 9.2 million tons, of which about 2.6 million tons are off-balance sheet reserves, with a more detailed level of research. Potential uranium reserves are estimated at around 1,000 tons.

Renewable energy

Renewable energy sources are the main driver and carrier of the energy transition towards a carbon-neutral energy and economy. The fight against climate change has become an international obligation for almost all countries in the world, which have pledged to prevent an increase in the average temperature on the planet by 2 °C compared to the pre-industrial period and to reduce the emission of GHG in 2030 by 45 % compared to emissions from 2010. Europe has set an ambitious plan – zero emissions of harmful gases by 2050.

From 2015 to today, Serbia has made significant progress in the field of renewable energy sources, primarily by building seven wind farms with a total capacity of 398 MW. According to data from 2019, the share in gross final energy consumption was around 21.5% and given that no large new RES projects were connected during 2020, the percentage certainly did not increase significantly.

According to the projections of the Energy Development Strategy of the Republic of Serbia until 2025 with projections until 2030, the total potential of renewable energy sources in our country amounts to 5.65 million toe (tons of oil equivalent) per year. Potential utilization, according to the latest available data from 2019, is 2.06 million toe of RES.

In April 2021, Serbia adopted a new Law on the Use of Renewable Energy Sources, which should modernize the incentives system, by replacing the administratively allocated feed-in tariff model with market premiums and auctions as a way of granting incentives.

Wind Energy

The potential of wind energy depends, apart from natural conditions, on the technical capabilities of the power system to integrate it.

So far, 8 wind power plants with a total power of 398 MW have been connected to the power system of the Republic of Serbia. Projects with a total power of 4 GW are under development.

The technically usable wind potential is determined based on the existing technical capabilities of the power system to take over this energy. Additional assumptions when determining the potential are that the maximum variation of electricity production from wind energy will not coincide with the maximum variation of electricity production from solar power plants and that the maximum variation will not exceed 90 % of the total installed capacity. INECP projects a capacity of 1.77GW of wind by 2030 and 1.73GW of PV, for which, according to the recent study, the hourly day-ahead reserves requirements should be 1250 MW[35].

Solar energy

As in the case of the potential of wind energy, the potential of using solar energy depends, apart from natural conditions, on the technical capabilities of the power system.

So far, 107 solar power plants with an installed capacity of 12 MW have been built in Serbia and received incentive prices (feed-in tariffs). We are talking about low-power facilities on the ground and on the roof.

In the coming years, an investment boom in the field of solar energy and the arrival of large investors in the field of solar energy is expected, because the potential of solar energy is very little used. It is estimated that more than 100 MW of solar parks are in the early stages of development. It is an encouraging fact that JP Elektroprivreda Srbije plans to build the solar power plant Petka, with a capacity of 9.95 MW, for which all necessary permits have been obtained.

According to the Law on the Use of Renewable Energy Sources, which defines the use of RES as a public interest, of particular importance for the Republic of Serbia, namely, it is the first time that households and industry can become buyers-producers (prosumers), and citizens can form a community renewable energy sources. Households and industry will thus be able to install RES power plants on their premises (which are usually solar panels) and use that energy for their own consumption and deliver the surplus to the grid or store it for later use.

The technically usable energy potential for the conversion of solar energy into thermal energy (for the preparation of hot water and other purposes) is estimated at 0.194 million teo per year, assuming the application of solar thermal collectors to 50 % of the available facilities in the country. As for electricity production, the basic technical limitation, as in the case of wind, is the power system's ability to accept this energy in the summer months since it is a variable production. The construction of new conventional electric power capacities (coal, natural gas, large hydropower plants), and especially reversible hydropower plants (RHPP Bistrica and/or Đerdap 3), as well as other energy storage systems will significantly increase the technically

[35] D. Orlic et al. “Large-Scale RES Integration in Serbia”, EKC, prepared for USAID and USEA, Jul. 2022

available potential of these intermittent sources, due to the expansion of power balancing in the system.

Hydropotential

About 80 % of electricity from renewable sources in Serbia comes from hydro-potential. Serbia 2,941MW installed hydroelectric power.

The status of producer from renewable sources was acquired for 2,355 MW in large hydroelectric power plants within the system of Elektroprivreda Srbije (EPS), whose annual production is about 10 TWh.

EPS also owns 15 small hydropower plants with a total capacity of 20 MW. Also, private investors have built 122 small hydropower plants with a total capacity of 77.61 MW within the feed-in tariff system, while 32 MHE with a total capacity of about 30 MW are in the status of temporary privileged producer and construction.

Hydroelectric power plants make up about 30 percent of the total electricity production of JP EPS, of which more than two thirds is production at HPP Đerdap. Apart from HPP Đerdap, EPS produces electricity in Drina-Lim hydropower station "Bajina Bašta".

Due to the impact of hydroelectric power plants on the environment, the Law on the Use of Renewable Energy Sources foresees a ban on the construction of small hydroelectric power plants in protected areas, unless the Government decides that it can be built because the hydroelectric power plant is in the public interest.

The total theoretically available hydropower potential of water that flows through watercourses in the territory of the Republic of Serbia is about 25,000 GWh/year. The largest part of the hydropotential (over 70 %) is concentrated only on a few watercourses with a potential above 1,000 GWh/year: Danube, Drina, Velika Morava, Lim and Ibar. On the other hand, on several rivers in the Republic of Serbia, the hydropower potential will only be able to be partially used, due to the priority of water management use of water, because some rivers are planned as sources of regional water systems: Toplica, Crni Timok, Rasina, Studenica, Veliki Rzav, Mlava, Lepenac.

Technically usable potential in the Republic of Serbia is about 19.5 TWh/year, of which about 17.7 TWh/year is in facilities larger than 10 MW. So far, 16 hydroelectric power plants have been built and an average of 10.5 TWh per year is produced [36]. The total technical potential of hydroelectric power plants up to 10 MW is estimated at around 1,800 GWh per year.

The remaining technical hydropotential and the possibility of its utilization will be determined in accordance with non-energy criteria related to the multi-purpose use of water and environmental protection problems, as well as based on agreements on the sharing of hydropotential with neighbouring countries. Also, given that the estimated potential of small hydropower plants is based on the Cadastre of small hydropower plants from 1987, a detailed

[36] Twenty-year average

audit of locations will continue in the coming period, in order to create a more precise list of feasible locations and create a better planning basis for the use of this renewable source. Also, for the entire hydropower sector, it is necessary to consider the impact of climate change on the availability of watercourses for electricity production. This is important for considering the expected production of electricity from existing hydroelectric power plants, as well as for the possible potential of hydropower for the construction of new hydroelectric power plants.

Biomass

Biomass represents a significant energy potential of the Republic of Serbia. The potential of biomass is estimated at 3,448 million toe and in the total potential of RES it participates with 61 %. Of this potential, the largest part is the potential of wood biomass - 1.53 million teo and the potential of agricultural biomass - 1.67 million teo (residues from farming, livestock, fruit growing, viticulture and primary fruit processing), while the potential of biodegradable municipal waste is estimated at 205 thousand teo.

Biodegradable waste (apart from municipal waste) also includes waste edible oils and waste of animal origin (slaughterhouse waste) in a total amount of 0.043 million teo/year.

Biomass potential is available throughout the territory of the Republic of Serbia. Wood biomass is mostly found in the area of central Serbia, and agricultural biomass in the area of Vojvodina. However, while the degree of utilization of the potential of wood (forest) biomass is relatively high (66.7 %), the potential of agricultural biomass is slightly used (~2 %), while the potential of biodegradable municipal waste is not used at all. The potential of biomass (especially agricultural) is a dynamic category, and in order to increase it, it is necessary to undertake appropriate activities on the use of land that was not cultivated, as well as the use of marginal land in the production of biomass for energy purposes (energy plantations). According to data from the Energy Development Strategy of the Republic of Serbia until 2025, the greatest potential of Serbian renewable energy sources is in biomass and reaches 3.4 toe (tonnes of oil equivalent), which is more than half of the defined national potential. Biomass potential includes agricultural biomass, forest waste, biodegradable waste and liquid manure. Bearing in mind that according to the official registry of the Ministry of Mining and Energy, only one biomass power plant has the status of a privileged producer of electricity, the potential of biomass is very poorly used. Several biomass power plants with relatively small capacity are under development.

Biomass can be used as an energy source for the production of electricity and heat, and it is also used in transport as biofuel. Biomass is also used to produce biogas, which can further be used to produce electricity.

Geothermal energy

The Republic of Serbia is located in the zone of favourable geothermal potential and resources.

Geothermal energy includes petrothermal and hydrogeothermal energy sources, which the Republic of Serbia is abundant to a significant extent. The use of geothermal energy for heating and other energy purposes in the Republic of Serbia is in its initial phase and is very modest in relation to potential and resources. The geothermal potential of the Republic of Serbia is clearly demonstrated by the existence of a large number of spas and natural springs with water temperatures higher than 30 °C and varying degrees of natural bounty. Based on existing measurements, the heat flow is above the average for Europe (60 mW/m^2), that is, it ranges from 80 to 120 mW/m^2. Natural and artificial sources of thermal water have been identified on the territory of over 60 municipalities. The water temperature is usually in the range of up to 40 °C, and only in the territory of six cities/municipalities (Vranje, Šabac, Kuršumlija, Raška, Medveđa, Apatin) is the water temperature over 60 °C. Average water flows from existing sources and wells are up to 20 l/s. In several localities, the water flow exceeds 50 l/s (Bogatić, Kuršumlija, Pribojska Banja, Niška Banja), and only in one location the water flow exceeds 100 l/s (Banja Koviljača). The total thermal power that could be obtained by using all existing sources of thermal water amounts to about 216 MWt, with the production of thermal energy of 180 thousand tonnes. A significant, but overlooked, geothermal potential lies in the use of negative and water-logged oil and gas wells in Vojvodina, where exploitation has been completed.

Geothermal energy is a largely untapped resource in Serbia, especially in the Pannonian basin. Except in spas whose development is just beginning in the form of spa tourism, thermal springs can be used to produce thermal energy for district heating systems. Foreign investors have been exploring possible locations for the construction of geothermal power plants for several years.

Hydrogen

Green hydrogen is recognized in the RES Law as an energy source whose use in Serbia should be encouraged and developed. Numerous studies are being done and presented in Europe.

This energy source is obtained by the long-known process of electrolysis, but the condition for hydrogen to be "green" is that the electricity used for its production comes from renewable sources (unlike hydrogen, which is now used in industry and emits harmful gas emissions). Burning hydrogen produces water, which is why it is completely safe for the environment.

3.5.9.8.2 Current state of electricity and gas markets, including energy prices

In Serbia the electricity day-ahead marked is operated by South-eastern European power exchange (SEEPEX) the market/power exchange which was established in 2015 on the basis of partnership between EMS JSC and EPEX SPOT – France as a joint stock company with the majority ownership of the Serbian side. It is licenced for organized electricity market operation. There were 22 participants registered in 2020 on an organized day-ahead electricity market/power exchange which is three participants more than in 2019. In average 18 participants were actively involved in the trade amounting to the same number as year before.

In 2020, suppliers mainly traded between themselves in the wholesale electricity market because there are existing wind parks operate as privileged producers and sell electricity to the guaranteed supplier at feed-in tariffs. The suppliers' activity in the open market is the most intensive in the field of cross-border exchange, mostly with the purpose of transit via Serbia which is dominant due to central geographic position of the power system of Serbia in the region. In 2020, it amounted to around 14.7 TWh. There were 57 active market players and 11 suppliers dealing with final customers supply in the open market in 2020. The electricity supply activities are mostly related to the commercial consumers. There were in total 64 energy entities with supply licenses of which 11 were active in supplying the final consumers. The most dominant supplier is EPS with more than 95% of the electricity sold to final consumers. **Error! Reference source not found.** presents average retail prices in the open market, without VAT and duties fees.

On December 23, 2022, the Agreement on the establishment of the regional electricity exchange ADEX was signed, the founders and co-owners are ELES (Slovenian TSO), EMS and EPEX-SPOT. The key business goal of the newly created electricity exchange is the launch of the intraday electricity market and the integration of ADEX with pan-European electricity markets. The start of operation of the intraday electricity market in Serbia is planned for late June or early July 2023, which is very important for increasing the share of variable RES in the EES of Serbia.

Households and small consumers are entitled to guaranteed supply have a regulated price at regulated market. Evolution of electricity prices for households is presented in Figure 3.63.

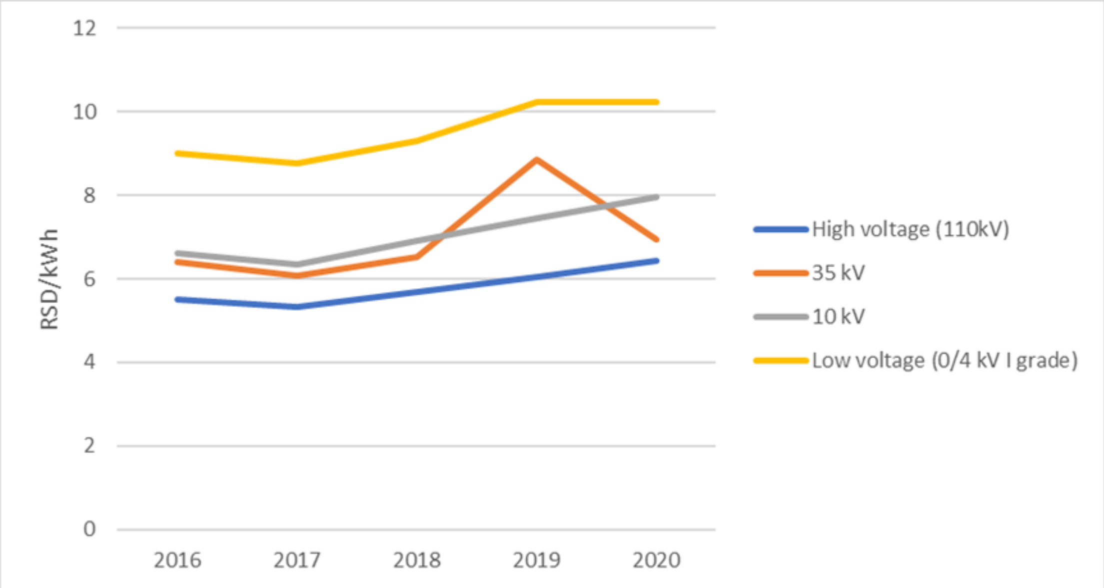


Figure 3.62: Average annual retail prices in the open market, excluding VAT and duties free (source: AERS)

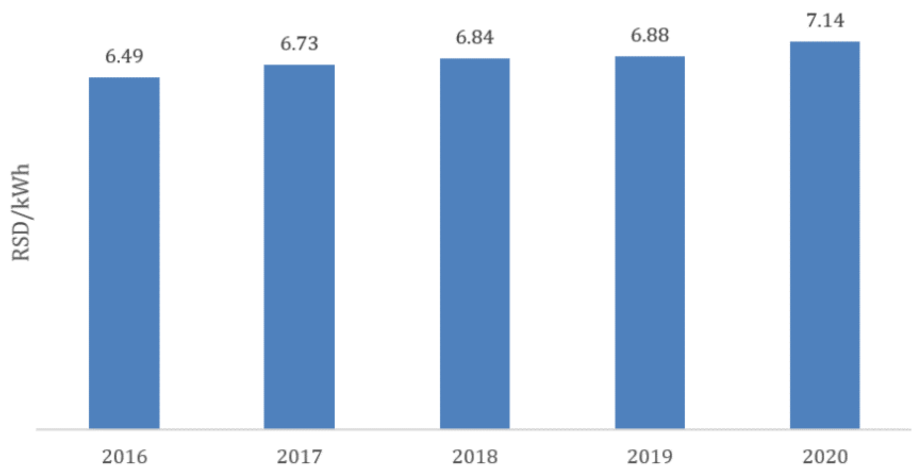


Figure 3.63: Average annual retail prices regulated market, excluding VAT and duties free (source: AERS)

In the natural gas wholesale market, there are three licenced natural gas suppliers and one producer which were active in 2020, where trading is preformed via bilateral agreements. Until a competitive natural gas market is established, the Government of the Republic of Serbia appoints the supplier of public suppliers. There were 26 active suppliers in the open market who dealt with retail in 2020 while there were 31 public suppliers who also acted as natural gas distributers. Historical data for natural gas public supply price and Average weighted retail price in the regulated market are presented below.

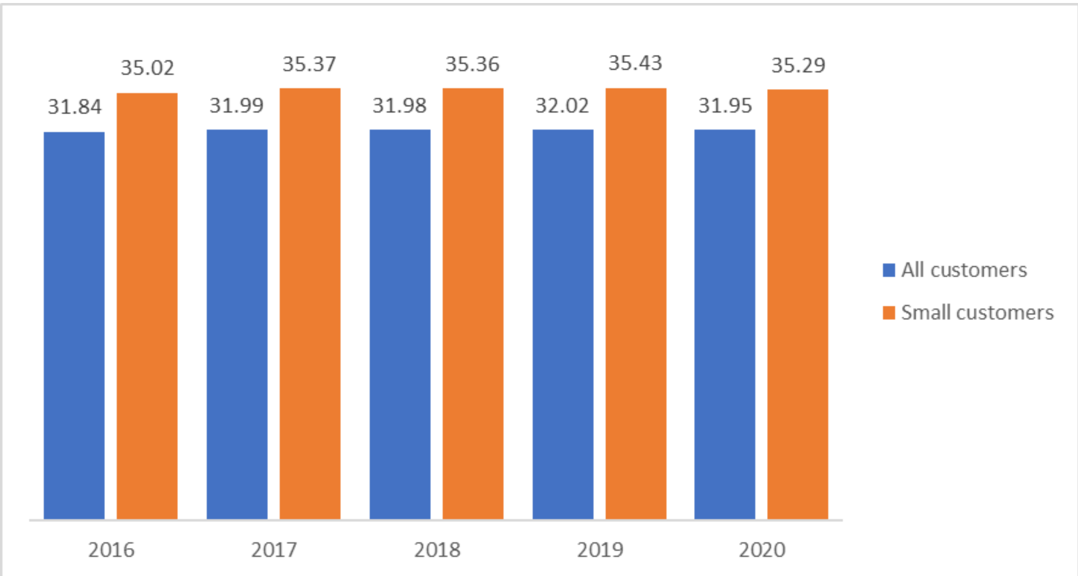


Figure 3.64: Average approved natural gas public supply price (source: AERS)

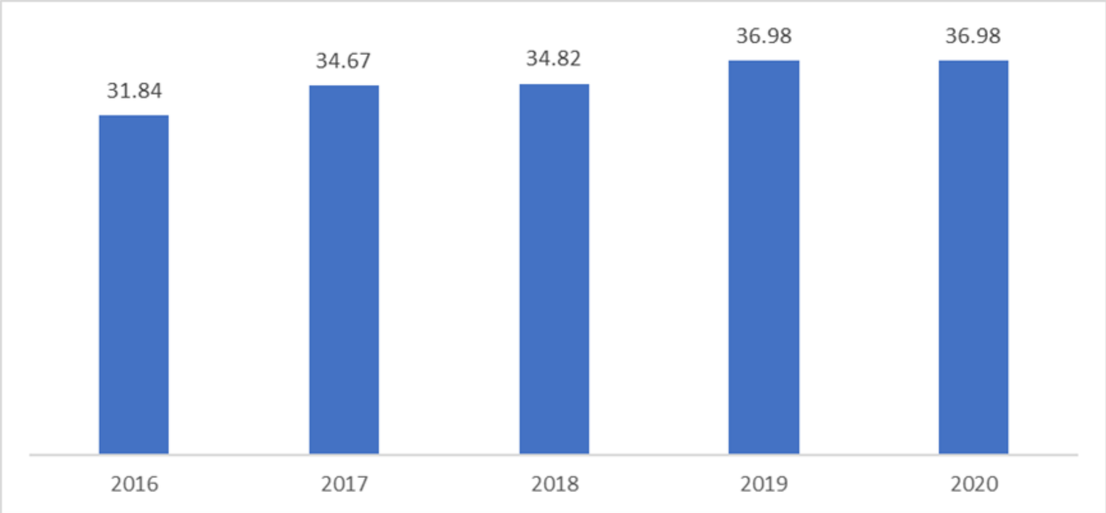


Figure 3.65: Average weighted retail price in the regulated market

3.5.10 Cultural heritage

The general interest in culture is regulated by the Law on Culture (Official Gazete of the Republic of Serbia, No. 72/2009). The Law defines that culture policy is based on freedom of expression in cultural and artistic creation, autonomy of cultural operators, openness and availability of cultural events for the public and citizens, respect for cultural and democratic values of the European and national tradition and diversity of cultural expressions.

Also, the general interest in culture includes creation of possibilities for intensive and harmonised cultural development, creation of conditions for the stimulation of cultural and artistic creation, research, protection and use of cultural goods as well as securing conditions for public availability of cultural heritage.

Serbia has five properties included in the UNESCO World Heritage List[37]:

- Gamzigrad-Romuliana, Palace of Galerius (2007)
- Stari Ras and Sopoćani (1979)
- Stećci Medieval Tombstone Graveyards (2016)
- Studenica Monastery (1986)

An additional 11 sites are on the “Tentative list” , which is an inventory of those properties which each State Party intends to consider for nomination:

- Djerdap National Park 2002
- The Deliblato Sands Special Natural Reserve 2002

[37] https://whc.unesco.org/en/statesparties/RS/

- Mt. Sara National Park 2002
- The Tara National Park with the Drina River Canyon 2002
- The Djavolja Varos (Devil's Town) Natural Landmark 2002
- Fortified Manasija Monastery 2010
- Negotinske Pivnice 2010
- Smederevo Fortress 2010
- Caričin Grad – Iustiniana Prima, archaeological site 2010
- Cultural landscape of Bač and its surroundings 2019
- Frontiers of the Roman Empire – The Danube Limes 2020

The figure below presents the relevant institutional framework[38]:

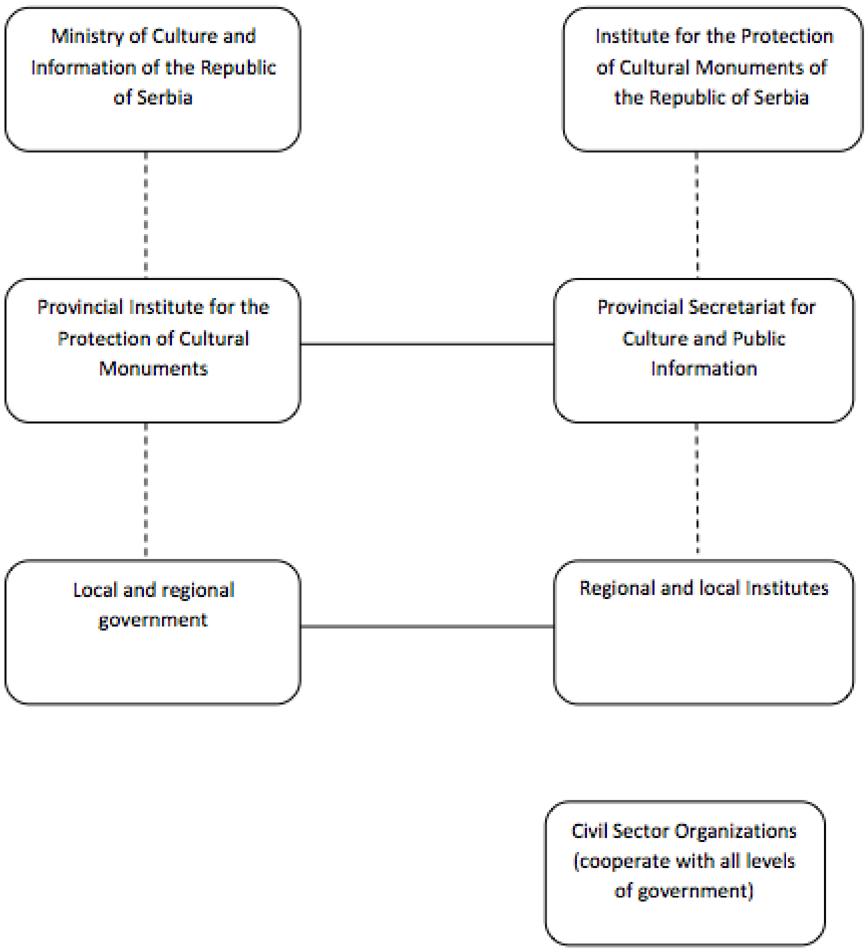


Figure 3.66: Cultural Heritage institutional framework

[38] https://www.coe.int/en/web/herein-system/serbia

The protection of immovable cultural heritage in the Republic of Serbia is managed at three different levels: state, provincial and local level. At state level, the **Ministry of Culture** is in charge of public administration duties regarding the development and improvement of culture. The Sector for Cultural Heritage Protection, within the ministry, is responsible for analyzing and monitoring the situation in the field of cultural goods protection and it proposes strategies and measures aimed at its improvement.

Apart from the Ministry of culture, **14 different provincial institutes for protection of cultural monuments** (IPCMs) exist in the territory of Serbia: one at national level, two at provincial level, two at city level and nine at regional level. In addition to the IPCM network, the Government of Serbia established the Central Institute for Conservation with the idea of centralizing conservation of both movable and immovable cultural heritage. In accordance with the Law on Cultural Heritage (1994), currently in force in Serbia, the ICPMs are responsible for research on immovable cultural goods; drafting studies and projects for undertaking works in addition to providing insights into the implementation of measures for protection and utilization of immovable cultural goods; participating in the procedure of preparing spatial plans; and publishing studies on the work undertaken on immovable cultural goods.

As a national institution, the **Institute for Protection of Cultural Monuments of Serbia (IPCMS)** is responsible for a competent assessment of the condition of immovable cultural goods of great and exceptional significance, and it undertakes measures regarding their protection and utilization.

The IPCMS is in charge of the central registry of cultural goods and is responsible for the initiation of the process to declare immovable properties as cultural goods and to establish immovable cultural goods of great and exceptional significance. There are currently registered 2508 immovable cultural properties in the central register[39].

Legal instruments in the field of cultural heritage protection in the Republic of Serbia include:

- Law on Culture, (RS Official Gazette No 71/09) from 2009;
- Law on Cultural Property (RS Official Gazette No 71/94) from 1994;
- Law on the restoration of cultural-historical heritage, and the boosting of the development of Sremski Karlovci (RS Official Gazette No 37/91, 53/93, 67/93 and 48/94) from 1991, amended in 1993 nad 1994;

Additionally, Serbia has ratified the following International Conventions:

[39] https://www.coe.int/en/web/herein-system/serbia

- UNESCO Convention for the protection of cultural property in the event of armed conflict (The Hague,1954) (ratified in 1956);
- UNESCO Convention on the means of prohibiting and preventing illicit import, export and transfer of ownership of cultural property, 1970 (ratified in 1973);
- UNESCO Convention concerning the protection of world cultural and natural heritage 1972 (ratified in 1974);
- UNESO Convention on the preservation of intangible cultural heritage (Paris, 2003) (ratified in 2010);
- UNESCO Convention on the protection and promotion of the diversity of cultural expressions (Paris 2005) (ratified in 2009);
- European convention on the protection of architectural heritage,Council of Europe (Granada, 1985) (ratified in 2001);
- European convention on the protection of archaeological heritage (revised) (Valletta, 1992) (ratified in 2008);
- Council of Europe Framework convention on the value of cultural heritage for society (Faro, 2005) (ratified in 2010);
- European landscape convention, Council of Europe (Florence, 2000) (ratified in 2011)

3.6 CONSIDERATION OF ISSUES AND PROBLEMS OF ENVIRONMENTAL PROTECTION AND REASONS FOR OMITTING CERTAIN ISSUES FROM THE ASSESSMENT PROCEDURE

The criteria for determining the possibility of significant impacts of plans and programs on the environment are contained in Annex I of the Law on Strategic Impact Assessment.

When it comes to the characteristics of INECP and the impact on the environment of the implementation of the adopted scenario, it is especially important to identify environmental protection problems in the area(s) affected by the INECP, and analyse possible implications for the quality of the environment and human health, especially in the following areas:

- The quality of the basic factors of the environment: air, water, soil,
- Natural resources as the basis for the development of the economy,
- Human health and social development.

Within the frame of the strategic impact assessment, issues and problems in relation to environmental protection and socio-economic aspects were analysed for the following areas covered by INECP:

- decarbonisation with a special focus on the increased use of renewable energy sources including the impacts (positive and negative) of the "green" energy obtained from renewable sources and the reduction of the carbon footprint,
- measures to increase energy efficiency in all sectors,
- energy security with special attention to the diversification of energy sources,
- the integrity and functionality of the energy market within the Energy Community through the establishment of an internal energy market and
- research, innovation and competitiveness.

3.6.1 Discussed Issues and Problems of Environmental Protection

By considering the assessment of the state of the environment, the following issues were specifically considered in the areas covered by INECP:

- Construction of the new thermal power plant "Kostolac B3" and decommissioning of the existing thermal power plants;
- Potential problems in biodiversity that may arise as a result of increased electricity production from RES (wind power plants, photovoltaic plants, biogas plants, etc);
- Endangered nature and environment in the radius of the Drmno-Kostolac surface mine (due to capacity expansion) and new mines in the Kolubara region;
- Poor infrastructure for the collection, treatment and disposal of municipal waste on the territory of Serbia;
- Insufficient investment in environmental protection and climate change;
- Non - existence of a program for monitoring the state of the environment and an information system on the state of environmental parameters in the entire territory of Serbia and the underdevelopment of the system for monitoring the state of the environment and changes in space at the national level.

3.6.2 Reasons for Omitting Certain Questions and Problems from the Assessment Procedure

The level of information at the policy and planning level often leads to limitations in the availability of information, and reasonable uncertainty regarding action implementation impacts. The INECP is a long-term strategic document, with defined policy measures; the impacts of the implementation of certain policy measures are however yet unknown especially with regards to the spatial location and individual capacities of future projects, with few exceptions.

Certain issues from the environmental protection field could therefore not be considered, given that the impact of existing facilities and projects/activities provided in the INECP, which are the source of possible negative impacts on the environment could not be determined with certainty at the level of SEA. Assessment of such impacts will be carried out at lower hierarchical levels of planning and design. More particularly, pursuant to provisions of the Law on Strategic Environmental Assessment ("Official Gazette of the Republic of Serbia", Nos. 135/04 and 36/09), the Study on Environmental Impact Assessment can be required for individual energy facilities and other facilities and networks. In relation to the planned activities set forth in the INECP, and in relation to the Ordinance on determining the List of projects for which an impact assessment is mandatory and the List of projects for which an impact assessment may be required is included in "Official Gazette of the Republic of Serbia", No. 114/08.

3.6.3 INECP areas covered

To facilitate the assessment of areas covered by the INECP, the below matrix was used, where PM are grouped for evaluation of their impact(s) based on the primary Dimension they affect. The grouping and correlation of PM with other relevant Energy Union dimension(s) as reflected in the INECP (decarbonisation, energy efficiency, energy security, internal energy market and research, innovation and competitiveness) is presented below.

In the matrix, the link was considered according to the following ranking:

Primary Dimension affected	**Additional Dimension affected**

Table 3.20: Link PM / Dimensions affected.

No.	Name of policy or measure	Decarbonisation		Energy efficiency	Energy security	Internal energy market	Research, innovation and competitiveness
		Reduction of GHG emission	RES				
GREENHOUSE GAS (GHG) EMISSIONS AND REDUCTION							
PM_D1	Preparation for and Introduction of carbon tax						
PM_D2	Adoption, Implementation and monitoring of the Low-carbon Development Strategy and Action Plan for its implementation and developing an Adaptation Plan to Climate Change						
PM_D3	Promoting circular economy						
PM_D4	Organizing awareness campaigns for better information dissemination						
PM_D5	Establishment and operation of the National Climate Change Council, a Carbon Footprint Observatory for all sectors, and a National GHG inventory system						
PM_D6	Implementation and monitoring of Just Transition and related Action Plan						
PM_D5	Implementation of technological changes in production processes in specific industries						
PM_D6	Emission reduction measures in the refrigeration and air conditioning - fluorinated gas emissions						
PM_D14	Improvement of wastewater treatment and discharge						
PM_D15	Improvement of waste management practices, including a decrease of biodegradable components of waste disposed on landfills and increased recycling						
PM_D16	Higher percentage of municipal solid waste treated by biological treatment options						
PM_D17	Utilisation of the entire amount of methane (CH4) generated from all the dumped quantities of waste that end up in sanitary landfills						
PM_D18	Promotion of composting in both centralised and household perspectives						
PM_D7	Sustainable forest management (forest land remaining forest land)						
PM_D8	Land conversion to cropland						
PM_D9	Increase the tree-planted areas (groves / parks / green roofs)						
PM_D10	Measures for the reduction of CH4 emissions from the enteric fermentation of animals						
PM_D11	Improvement of manure management for the reduction of CH4 and N2O emissions						

No.	Name of policy or measure	Decarbonisation		Energy efficiency	Energy security	Internal energy market	Research, innovation and competitiveness
		Reduction of GHG emission	RES				
PM_D12	Measures for the reduction of direct and indirect N2O emissions from managed soils						
PM_D13	Measures for reducing emissions from fertilizers use						
RENEWABLE ENERGY SOURCES (RES)							
PM_D19	Support scheme based on tendering procedures (auction scheme) for commercially cost-effective RES technologies						
PM_D20	Application of the legislative framework for the participation of the RES producers in electricity market						
PM_D21	Support RES technologies that will not participate into the tendering procedures						
PM_D22	Provision of economic support to innovative and demonstration pilot RES projects						
PM_D23	Fostering the further utilization of guarantees of origin for energy from RES						
PM_D24	Updating, simplifying and optimizing the authorization, certification, permit-granting and licensing procedures - Establishment of One stop shop						
PM_D25	Updating, simplifying and optimizing the spatial planning framework						
PM_D26	Updating, simplifying and optimizing the grid connection procedures and setting detailed methodology and allocation rules for RES grid connection costs						
PM_D27	Fostering the self-consumption of the produced electricity						
PM_D28	Establishing publicly accessible registry for RES electricity producers						
PM_D29	Adaptation, enhancement and expansion of the grid networks for avoiding congestions and enabling the optimal penetration of RES						
PM_D30	Promotion of RES for heating and cooling in new and renovated buildings						
PM_D31	Provision of fiscal and economic incentives to foster RES in heating and cooling						
PM_D32	Facilitating the penetration of RES into district heating networks						
PM_D33	Fostering the production of biofuels in transport sector						
PM_D34	Fostering the consumption of biofuels in transport sector						
PM_D35	Development of the required infrastructure for recharging electric vehicles						

No.	Name of policy or measure	Decarbonisation		Energy efficiency	Energy security	Internal energy market	Research, innovation and competitiveness
		Reduction of GHG emission	RES				
PM_D36	Provision of fiscal and economic incentives to foster the further deployment of electric vehicles						
PM_D37	Promotion of renewable energy communities						
PM_D38	Development of the legislative framework and provision of incentives for the promotion of energy storage technologies						
PM_D39	Supporting demonstration projects for the promotion of biomethane and renewable hydrogen						
PM_D40	Development of the required legislative framework and the required infrastructure for the deployment of biomethane and renewable hydrogen						
PM_D41	Development of effective supply chains for the exploitation of the available potential of biofuels, bioliquids and biomass						
PM_D42	Specification of the sustainability and GHG emissions saving criteria for biofuels, bioliquids and biomass fuels including the required monitoring and verification activities						
PM_D43	Conduction of information and training activities to all to all relevant actors for the use of RES including the development of a certification scheme for RES professionals						
PM_D44	Promotion of RES through green public procurements						
ENERGY EFFICIENCY							
PM_EE1	Financing and fiscal measures for the renovation of residential buildings						
PM_EE2	Financing and fiscal measures for the renovation of public buildings						
PM_EE3	Financing and fiscal measures for the renovation of non-residential buildings (not public)						
PM_EE4	Completion of legislative framework in alignment with Directive 2018/844/EU and regulatory measures to promote near-zero energy buildings (nZEBs)						
PM_EE5	Programs for the renovation of buildings exceeding minimum energy requirements (nZEBs)						
PM_EE6	Mandatory installation of solar thermal systems in new buildings and in buildings undergoing major renovation						
PM_EE7	Enhancing the role of the energy performance certificates						
PM_EE8	Overcoming split incentive barrier						

No.	Name of policy or measure	Decarbonisation		Energy efficiency	Energy security	Internal energy market	Research, innovation and competitiveness
		Reduction of GHG emission	RES				
PM_EE9	Promotion of energy efficient, lighting systems, electric appliances and office equipment						
PM_EE10	Promotion of energy efficient passenger and light-heavy duty vehicles						
PM_EE11	Ensuring the energy efficiency in imported used passenger cars						
PM_EE12	Financing programs for the promotion of energy efficiency passenger vehicles						
PM_EE13	Development of the required infrastructure for the promotion of alternative fuels						
PM_EE14	Promotion of energy efficiency of the freight transport						
PM_EE15	Promotion of modal shift both for passenger and freight transport - Enabling ‘Mobility as a Service’ (MaaS)						
PM_EE16	Promotion of energy efficiency in inland waterways transport						
PM_EE17	Promotion of energy efficiency in rail transport						
PM_EE18	Continuous enhancement and extension of the relative infrastructure for public transport						
PM_EE19	Development of sustainable regional or municipal mobility plans						
PM_EE20	Supplementary actions for the promotion of energy efficiency in transport sector						
PM_EE21	Support schemes for the promotion of energy efficiency in industrial sector						
PM_EE22	Regulatory measures for the promotion of energy efficiency in industrial sector						
PM_EE23	Supplementary actions for the promotion of energy efficiency in industrial sector						
PM_EE24	Support schemes for the promotion of energy efficiency in agricultural sector						
PM_EE25	Advisory services and energy audits for farmers						
PM_EE26	Promotion of energy services and energy performance contracts through targeted financing programs						
PM_EE27	Promotion of energy services and energy performance contracts through supplementary activities						
PM_EE28	Mandatory conduction of energy audits and development of energy management systems						
PM_EE29	Promotion of energy audits in SMEs and in households						

No.	Name of policy or measure	Decarbonisation		Energy efficiency	Energy security	Internal energy market	Research, innovation and competitiveness
		Reduction of GHG emission	RES				
PM_EE30	Financing programs for the energy upgrading of street lighting						
PM_EE31	Conduction of awareness raising activities						
PM_EE32	Promotion of energy-efficient products through the implementation of energy labelling and eco-design Directives						
PM_EE33	Promotion of green public procurements						
PM_EE34	Regulatory measures and financing programs for promoting/modernizing high efficient CHP units and district heating/cooling networks						
PM_EE35	Development of a scheme for the qualification, accreditation and certification of energy efficiency professionals						
PM_EE36	Promotion of energy efficiency in water supply, distribution and consumption						
PM_EE37	Strengthening the technical and administrative capacity of the involved policy makers						
PM_EE38	Development of sustainable and innovative financing of energy efficiency projects						
PM_EE39	Improve the bankability of energy efficiency projects						
PM_EE40	Deployment of smart meters (synergies with energy market dimension)						
PM_EE41	Promotion of smart and carbon neutral cities						
PM_EE42	Promotion of measures for improving energy efficiency in electricity infrastructure						
PM_EE43	Promotion of measures for improving energy efficiency in natural gas infrastructure						
PM_EE44	Promotion of demand response and dynamic pricing and tariffs						
ENERGY SECURITY							
PM_ES1	Gas interconnector Serbia Bulgaria (MG10)						
PM_ES2	Enhancement of regional electricity and gas interconnections						
PM_ES3	Building capacities for energy storage						
PM_ES3.1	Banatski dvor, natural gas storage						
PM_ES3.2	Creating mandatory reserves of oil and petroleum products						
PM_ES4	Creating operational reserves of oil, coal and other energy derivatives						
PM_ES5	Creating mandatory natural gas reserves						
PM_ES6	Electricity Risk Preparedness plan						

No.	Name of policy or measure	Decarbonisation		Energy efficiency	Energy security	Internal energy market	Research, innovation and competitiveness
		Reduction of GHG emission	RES				
PM_ES7	Update in Security of supply regulation (at least at a national level)						
PM_ES8	Oil product pipeline from Pančevo refinery to Novi Sad, Sombor, Belgrade and Niš, through Smederevo and Jagodina						
PM_ES9	Development of a pumped storage project in Bistrica						
PM_ES10	Development of additional dispatchable generation from natural gas						
PM_ES11	Modernisation of the coal mining industry						
INTERNAL ENERGY MARKET							
PM_IEM1	Implementation of Transbalkan Corridor: OHL SS Kragujevac (RS) - Kraljevo (RS)						
PM_IEM2	Implementation of Transbalkan Corridor: OHL Obrenovac (RS) - Bajina Basta (RS)						
PM_IEM3	Implementation of Transbalkan Corridor: OHL B.Basta (RS) – Visegrad (BA) – Pljevlja (ME)						
PM_IEM4	Interconnection between Resita (RO) and Pancevo (RS) (PCI 3.22.1)						
PM_IEM5	Pannonian corridor						
PM_IEM6	Central Balkan Corridor						
PM_IEM7	RES integration cluster of projects - North CSE Corridor						
PM_IEM8	Regional gas connection through the implementation of interconnection projects						
PM_IEM8.1	Implementation of the Serbia-Bulgaria gas interconnection project						
PM_IEM8.2	Project for Serbia-Romania gas interconnection 85.5 km (out of which 12.8 km is on the territory of the Republic of Serbia), with a capacity of 1.2 billion m3/year						
PM_IEM8.3	Project for Serbia-Croatia gas interconnection (95 km, with a capacity of 1.5 billion m3/year)						
PM_IEM8.4	Project for Serbia-BiH gas interconnection 90 km, with a capacity of 1.2 billion m3/year						
PM_IEM8.5	Main gas pipeline RG 11-02 Leskovac-Vladičin Han-Vranje 71 km.						
PM_IEM8.6	Gas pipeline - interconnection with Montenegro						

No.	Name of policy or measure	Decarbonisation		Energy efficiency	Energy security	Internal energy market	Research, innovation and competitiveness
		Reduction of GHG emission	RES				
PM_IEM8.7	Project for Serbia-Macedonia gas interconnection 70.7 km, with a capacity of 0.8 billion m3/year						
PM_IEM8.8	Project for Niš-Priština gas pipeline construction 65 km, with a capacity of 0.8 billion m3/year						
PM_IEM9	Investments related to the digitalisation of the networks aiming at increasing RES integration and improvement of quality of supply						
PM_IEM10	Cluster of network infrastructure projects in the wider area of Belgrade (BEOGRID)						
PM_IEM11	Smart meters roll out in electricity DSO						
PM_IEM12	Studies for gas in smart meters roll out in natural gas distribution						
PM_IEM13	Design and implement market and network data management model						
PM_IEM14	Promotion of demand response for the end-users by use of the dynamic tariff system						
PM_IEM15	Equipping gas distribution systems with metering and data collection devices (measuring equipment, measuring and operational platform, SCADA) necessary for the functioning and development of the gas market						
PM_IEM16	Appointment of the Nominated Electricity Market Operator (Article 183a in accordance to the amendments of the Energy Law)						
PM_IEM17	Development of the regulatory framework for the operation of the “producer-consumer” (prosumer) (Article 169 in accordance to the amendments of the Energy Law and Article 58 to 61 of the Law on the use of RES)						
PM_IEM18	Development of the regulatory framework for the operation of the “electricity storage” (Article 169 in accordance to the amendments of the Energy Law)						
PM_IEM19	Development of the regulatory framework for the operation of the “aggregator” (Article 169 in accordance to the amendments of the Energy Law)						
PM_IEM20	Development of the regulatory framework for the operation of the Renewable Energy Communities (RECs) and Citizen Energy Communities (CECs) (Article 62 to 66 and Article 77 of the Law on the use of RES)						
PM_IEM21	Implementation of EU Network Codes and Guidelines on electricity						

No.	Name of policy or measure	Decarbonisation		Energy efficiency	Energy security	Internal energy market	Research, innovation and competitiveness
		Reduction of GHG emission	RES				
	through appropriate amendments of the secondary legislation and adoption of additional rules, decisions and acts, where applicable.						
PM_IEM22	Unbundling and Certification of Transmission System Operators						
PM_IEM23	Implementation of Regulation (EU) 2017/459						
PM_IEM24	Implementation of Regulation (EU) 2017/460						
PM_IEM25	Implementation of Regulation (EU) 2014/312						
PM_IEM26	Reform of the Wholesale market to foster competition						
PM_IEM27	Further development of Retail market opening						
PM_IEM28	Update of the Grid Code of Srbijagas. Development of a grid code for Yugorosgaz Transport						
PM_IEM29	Intensify gasification efforts in Serbia						
PM_IEM30	Development of regulatory framework for biomethane						
PM_IEM31	Market coupling to the Single Day Ahead Market (SDAMC)						
PM_IEM32	Market coupling to the Single Intra Day Market (SIDC)						
PM_IEM33	Preparation and adoption of an action plan to ensure achievement for energy poverty reduction						
PM_IEM34	Regulatory measures for the protection of energy poor households and provision of allowances for the short-term alleviation of the energy poverty (i.e. energy card or social tariff)						
PM_IEM35	Preparation of special programs for the application of energy efficiency measures and the promotion of RES among energy vulnerable customers for the long-term confrontation of the energy poverty						
PM_IEM36	Facilitate access to alternative energy sources among energy vulnerable and other customers in order to reduce energy poverty						
PM_IEM37	Improvement of the tools and methodology for collecting data relevant to monitoring of energy poverty						
PM_IEM38	Awareness and information measures for the alleviation of energy poverty						
RESEARCH, INNOVATION AND COMPETITIVENESS							
PM_RIC1	Enhancement of the legal framework to encourage Research and Innovation						

No.	Name of policy or measure	Decarbonisation		Energy efficiency	Energy security	Internal energy market	Research, innovation and competitiveness
		Reduction of GHG emission	RES				
PM_RIC2	Establishment of a Joint State Aid Action on Research and Innovation in the field of Energy						
PM_RIC3	Establishment of a Multiannual Investment Plan for the strengthening of R&I infrastructures						
PM_RIC4	Integration of Serbia into the European Research Area and enhanced participation in EU's funded Energy R&I Programs						
PM_RIC5	Development of Innovation Hubs / Clusters, Start-ups, Spin-offs/Spin-outs						
PM_RIC6	Development of specialised Competence Centers						
PM_RIC7	Facilitation of the establishment of regional centres of research excellence						
PM_RIC8	Establishment and networking of Technology Transfer Offices of research organisations / institutes and Science Technology Parks						
PM_RIC9	Support the cooperation between research institutes and businesses in the technology transfer and exploitation of research results						
PM_RIC10	Development of innovative energy-saving technologies						
PM_RIC11	Development of innovative decarbonisation technologies, with emphasis on RES for electricity, heating/cooling production, hydrogen production, carbon capture, storage and utilisation (CCU-CCS) technologies						
PM_RIC12	Research on the digitization of energy networks and the development of smart grids						
PM_RIC13	Development of innovative technologies in transport and applications for micro-mobility						
PM_RIC14	Development of innovative energy storage applications						
PM_RIC15	Promote the inter-sectoral and geographical mobility of researchers						
PM_RIC16	Enhancing education / training to support the energy transition						
PM_RIC17	Promotion of entrepreneurship through research and innovation actions which are embedded in market functions						
PM_RIC18	Optimising support framework and schemes for promoting investments with a view to strengthening competitiveness						
PM_RIC19	Strengthening competitiveness through the establishment and operation of Special Target Funds						

No.	Name of policy or measure	Decarbonisation		Energy efficiency	Energy security	Internal energy market	Research, innovation and competitiveness
		Reduction of GHG emission	RES				
PM_RIC20	Promoting innovative circular economy technologies to improve businesses competitiveness						
PM_RIC1	Enhancement of the legal framework to encourage Research and Innovation						
PM_RIC2	Establishment of a Joint State Aid Action on Research and Innovation in the field of Energy						
PM_RIC3	Establishment of a Multiannual Investment Plan for the strengthening of R&I infrastructures						
PM_RIC4	Integration of Serbia into the European Research Area and enhanced participation in EU's funded Energy R&I Programs						

4 KEY ASPECTS OF THE APPROACH TO THE ENVIRONMENTAL IMPACT ASSESSMENT

According to Article 14 of the Law on Strategic Environmental Impact Assessment, the general and specific environmental objectives of the strategic assessment are defined based on: requirements and objectives related to environmental protection in other plans and programs, environmental protection objectives determined at the national and international level, collected data on the state of the environment and important issues, problems and proposals related to environmental protection in the plan or program. Appropriate indicators, which will be used in the strategic assessment, are selected based on defined specific objectives.

4.1 General and specific environmental objectives

The Environmental areas and general environmental objectives (EO) of the Strategic Environmental Impact Assessment (SEA) are defined based on the requirements and objectives related to environmental protection in other plans and programs, the environmental protection objectives determined at national level and environmental protection objectives of relevant sector documents.

The specific environmental objectives (SEO) are a concrete expression of the general objectives, presented in the form of guidelines for change and action (measures, works, activities) that will help to achieve these changes. The specific environmental objectives are, above all, a methodological measure used to manage/verify the Plan's impact on the environment. They should provide decision-makers with a clear picture of the fundamental impacts of the Plan on the environment, based on which decisions can be made in order to protect the environment and achieve the main goals of sustainable development.

The environmental areas, related general environmental objectives (EO) and specific environmental objectives (SEO) which were considered and on which the SEA focuses are presented in the table below:

Table 4.1: SEA areas and general and specific environmental objectives of SEA

SEA area	General Environmental Objectives	Specific environmental objectives
Climate change	**EO 01** Climate change mitigation and increased resilience to climate change	**SEO 01.1** Increased share of RES in gross final energy consumption to at least 33.6 % in 2030 **SEO 01.2** Increased energy efficiency and reduction of final consumption **SEO 01.3** Reduction of energy consumption in transport **SE01.4** Promotion of circular economy
Human health and quality of life	**EO 02** Protection of human health	**SEO 02.1** Reduction of air emission, including GHG emissions, by 40.3% in 2030 compared to 1990 **SEO 02.2** Ensured supply of adequate and healthy drinking water to the population **SEO 02.3** Reduction of noise and vibrations pollution **SEO 02.4** Reduction of electromagnetic radiation **SEO 02.5** Reduction of generated waste and improved treatment and disposal of waste
Natural and other disasters	**EO 03** Prevention and management of natural and other disasters	**SEO 03.1** Prevention of natural and anthropogenic-technological disasters.
Sustainable management of natural resources	**EO 04** Protection of surface and ground water (morphology, ecological status, quantity and quality)	**SEO 04.1** Improved status or ecological potential of bodies of water, including surface water and groundwater **SE 04.2** Sustainable use of water **SEO 04.3** Protection and sustainable use of agricultural and forest land
Biodiversity	**EO 05** Protection of biodiversity and geodiversity	**SEO 05.1** Preservation of biodiversity **SEO 05.2** Preservation of areas with nature protection status
Cultural heritage	**EO 06** Protection of cultural and historical heritage	**SEO 06.1** Preservation of the state of cultural heritage sites and archaeological remains.

SEA area	General Environmental Objectives	Specific environmental objectives
Landscape	**EO 07** Protection of the landscape	**SEO 07.1** Preservation of exceptional landscapes, areas of national recognition and recognizable and typological characteristics of the landscape
Socio-economic aspects	**EO 08A** Stable economic and social environment **EO 08B** Improvement in investments and infrastructure for climate change adaptation and mitigation	**SEO 08A.1** Ensure economic and social stability **SEO 08B.1** Increase of investments in energy infrastructure and environmental protection **SEO 08B.2** Improvement of institutions and personnel for environmental protection and climate change monitoring **SEO 08B.3** Improvement of research, innovation and competitive employment

4.2 Assessment of the compatibility of the strategy with environmental parameters and objectives

The Table below presents the correlation between the environmental objectives of the above environmental parameters and the INECP. The term "correlation" refers to the possibility of actions and measures under a thematic area of the INECP to influence a given environmental objective and, by extension, an environmental parameter.

Table 4.2: Correlation between environmental parameters, EO and INECP dimensions

Incompatible	Uncertain connection	Compatible	No Connection

#	Environmental area	EO	SEO	Dimension					
				Decarbonisation		Energy efficiency	Energy security	Internal energy market	Research, innovation and competitiveness
				Reduction of GHG emission	RES				
1	Climate change	EO 01	SEO 01.1						
			SEO 01.2						
			SEO 01.3						
			SEO 01.4						
2	Human health and quality of life	EO 02	SEO 02.1						
			SEO 02.2						
			SEO 02.3						
			SEO 02.4						
			SEO 02.5						
3	Natural and other disasters	EO 03	SEO 03.1						
4	Sustainable management of natural resources	EO 04	SEO 04.1						
			SEO 04.2						
			SEO 04.3						
5	Biodiversity	EO 05	SEO 05.1						
			SEO 05.2						

#	Environmental area	EO	SEO	Dimension						
				Decarbonisation		Energy efficiency	Energy security	Internal energy market	Research, innovation and competitiveness
				Reduction of GHG emission	RES				
6	Cultural heritage	EO 06	SEO 06.1						
7	Landscape	EO 07	SEO 07.1						
8	Socio-economic aspects	EO8A	SEO 08A.1						
		EO8B	SEO 08B.1						
			SEO 08B.2						
			SEO 08B.3						

4.3 SELECTION OF INDICATORS

Planning is a key link in the environmental change management system, and the initial and most important step in the planning process is the creation of an information database for identifying the current state of the area within the scope of INECP: **Baseline**. Based on the identification of the situation, appropriate measures can be taken in the planning process in order to effectively protect the environment.

Indicators as an integral part of the environmental management information system are a very important element of planning and one of the levels of a complex spatial information system. They are used to direct strategic solutions towards the achievement of set goals. Indicators are adapted to measuring and evaluating measures, policies and solutions given in the Plan from the perspective of potential damage to the environment, as well as for identifying harmful impacts that need to be reduced or eliminated. They are one of the instruments used to systematically identify, assess and monitor the state, development and conditions of the environment and identify the consequences. They are necessary as input data for strategic planning.

In 2008, the Republic of Serbia adopted the National Strategy for Sustainable Development ("Official Gazette of RS", No. 57/08), which defined the principles and priorities of sustainable development and 76 indicators for effective monitoring of Serbia's progress towards sustainable development. Indicators are also defined by the Law on Spatial Planning of the Republic of Serbia. Also, the Instruction issued by the Ministry of Science and Environmental Protection in February 2007 and the Regulation on the National List of Environmental Indicators ("Official Gazette of the Republic of Serbia", No. 37/2011) prescribes a list of indicators related to the environment that were used for this document.

When it comes to indicators of sustainable development, the task is to identify trends that point towards or away from sustainability, as well as to set goals for the improvement of the common good. The indicators were established based on an expert analysis from the set of UN indicators and the available indicators of the Republic of Serbia.

The information system should enable efficient provision of data and information that is processed and analysed in accordance with international and European methodologies. The environmental information system is managed by the Serbian Environmental Protection Agency (SEPA). It has been significantly improved in recent years, but still does not have all the necessary data.

In table a summary overview of general and specific environmental objectives and proposed indicators is given with an explanation of the choice of indicators.

Table 4.3: **Overview of general and specific environmental objectives and indicators with explanation of the choice of indicators**

SEA area	General Environmental Objectives	Specific Environmental objectives	Proposed Indicators	Justification
Climate change	**EO 01** Climate change mitigation and increased resilience to climate change	**SEO 01.1** Increased share of RES in gross final energy consumption to at least 33.6 % in 2030	Annual emission reduction (Gg CO_2-eq)	The implementation of various INECP measures affects the participation of RES in the gross final consumption of energy. By 2030 of the share of RES in gross final energy consumption must reach 33.6% compared to 1990 and the share of RES in electricity production must attain 45%.
		SEO 01.2 Increased energy efficiency and reduction of final consumption	Primary energy consumption	The application of various INECP measures is expected to affect the level of energy efficiency. The consumption of primary energy should be less than 15.9 Mtoe in 2030. At the same time, INECP envisages the renovation of 131 thousand dwellings and 7,681 thousand m2 of non-residential buildings (excluding public buildings) by 2030, as well as the renovation of public buildings of a surface of 1,026 thousand m2 to improve their energy efficiency.
		SEO 01.3 Reduction of energy consumption in transport	Final energy consumption	The implementation of various INECP measures affects the intensity of final energy use and it is expected the final energy consumption will be restrained at a level that doesn't exceed 9.7 (6) Mtoe in 2030
		SE01.4 Promotion of circular economy	Annual emission reduction (Gg CO_2-eq)	The shift to a circular pattern can lead to a significant reduction in GHG emissions through the recycling and re-use of materials, the more efficient use of resources and more eco-friendly product design, as well as the introduction of new circular business models, especially in industry, transport and the built environment. In line with the Waste Management Program for the period 2022 – 2031, published at the Official Gazette 12/2022 on 1st February 2022, National objectives are:

SEA area	General Environmental Objectives	Specific Environmental objectives	Proposed Indicators	Justification
				- Increasing the recycling rate of municipal waste to a total of 25% by weight by 2025 and 35% by 2030; - Increase the rate of preparation for reuse and recycling of municipal waste to a minimum of 55% by weight by the end of 2025 and a minimum of 60% by weight by the end of 2030; - Reduction of disposal of biodegradable waste in landfills by 2028, to 75% of the total amount of biodegradable waste generated in 2008; - By the end of 2029, a separate collection of at least paper, metal, plastic, glass and textiles to have been established. - Increase the bio-waste recycling rate to 20% by 2025 and 40% by 2029; - Increase the recycling rate of paper and cardboard to 25% by 2025 and 35% by 2029; - Reduction of waste disposal in unsanitary landfills to 0% by 2034.
Human health and quality of life	**EO 02** Protection of human health	**SEO 02.1** Reduction of air emission, including GHG emissions, by 40.3% in 2030 compared to 1990	- Emissions CO2, NOx, NMVOC, NH3 and PM - Structure of energy sources passenger freight traffic - Structure of household fuel consumption by type and quantity	INECP includes multiple measures aimed at reducing energy consumption and GHG emissions in households and transport, which has a great impact on achieving the goals of the energy and environmental policy of the Republic of Serbia, and therefore on the national emissions of pollutants in the air. The main objectives of the measures are to improve the protection of the environment and human health from the harmful effects of acidification, eutrophication of the soil and ground-level ozone, prevention of exceeding the critical level and critical load and effective protection of all population groups from known health risks due to air pollution. Total annual anthropogenic emissions of SO2, NOx,

SEA area	General Environmental Objectives	Specific Environmental objectives	Proposed Indicators	Justification
				NMVOC, NH3 and PM2.5 must be reduced in accordance with national emission reduction commitments that apply from 2020 to 2030 and from 2030 onwards. INECP is expected to contribute to a meaningful reduction of the GHG emissions by 2030, attaining a GHG emission reduction equal to 13.2% compared to 2010 level i.e. 33,3% compared to 1990 by 2030 (excluding non-energy related emissions from agriculture, waste, land use, land use change and forestry). The target for the overall emissions reduction for 2030 is 40.3% compared to the 1990 levels (including LULUCF)
		SEO 02.2 Ensured supply of adequate and healthy drinking water to the population	- Drinking water quality - Access to drinking water - Hydric epidemics	Implementation of various INECP measures (infrastructure development, improved soil management, wastewater management, overall climate change mitigation etc.) may affect the chemical-ecological status of surface and ground water, which may affect the quality / availability of drinking water. Measures can have a direct or indirect effect.
		SEO 02.3 Reduction of noise and vibrations pollution	Number of sources of noise that exceed the permitted noise level	INECP's measures envisage the development of infrastructure an installations that represent a source of noise (wind farms, construction of new facilities - especially hydroelectric plants), an increase in traffic flows, with the possibility of increased exposure to noise and vibrations.

SEA area	General Environmental Objectives	Specific Environmental objectives	Proposed Indicators	Justification
		SEO 02.4 Reduction of electromagnetic radiation	- Existing buffer zones in relation to sensitive areas - Proximity of sensitive areas to new devices/systems	The selected indicators refer to the identification of sensitive areas near the power grid. Distance from the grid can affect the impact on the environment
		SEO 02.5 Reduction of generated waste and improved treatment and disposal of waste	- Amount of generated waste of electronic and electrical equipment and waste batteries and accumulators - Amount of waste from the combustion of solid fuels in energy production - Amount of waste from construction, traffic, energy infrastructure and facilities - Amount of waste sludge that is generated by sedimentation in	Data on WEEE and waste batteries mainly refer to measures related to the accelerated introduction of solar energy. Data on waste batteries and accumulators relate to energy storage and the increase in the number of electric vehicles. The data on the amount of waste from the combustion of solid fuels in energy production refer to the gradual reduction of electricity production from fossil fuels. An increase in traffic is foreseen, as well as the expansion and upgrading of the traffic and energy infrastructure network. The increase in the share of RES is largely connected with the construction of RHE on the Danube and Bistrica.

SEA area	General Environmental Objectives	Specific Environmental objectives	Proposed Indicators	Justification
			storage lakes before HPP and MHPP dams	
Natural and other disasters	**EO 03** Prevention and management of natural and other disasters	**SEO 03.1** Prevention of natural and anthropogenic-technological disasters.	- Interventions in flooded areas - Potential new sources of disasters	Loss of life and economic and environmental damage are the most severe consequences of natural and man-made disasters. Analyses show that their number is increasing. Exposure to such disasters is mainly due to the effects of climate change and urban and industrial development. INECP envisages a series of measures that can significantly contribute to the mitigation of climate change; some measures are expected to engender certain changes, both negative and positive. These include e.g., HPPs that can make a big difference in flood safety (HE prevents small floods, due to inadequate management and disregard for extreme events). Anthropogenic-technological disasters represent a challenge that can lead to pollution of the environment and its basic factors; they can be a consequence of a human mistake, improper choice of location, non-compliance with safety criteria, failure of equipment, or other. With timely recording and correct mitigation approaches, it is possible to prevent or reduce the frequency of accidents. Facilities where the production of biofuels, biogas, hydrogen and methanation processes will take place may, depending on the presence of total hazardous substances in warehouses and production, belong to SEVESO facilities.

SEA area	General Environmental Objectives	Specific Environmental objectives	Proposed Indicators	Justification
Sustainable management of natural resources	**EO 04** Protection of surface and ground water (morphology, ecological status, quantity and quality)	**SEO 04.1** Improved status or ecological potential of bodies of water, including surface water and groundwater	- Serbian surface water quality indicator (SWQI). - Number/share of water bodies of surface water - Individual periodic assessment of chemical and ecological conditions / potentials - Number of groundwater bodies - Individual periodic assessment of chemical and quantitative status	The implementation of INECP envisages the implementation of projects that may affect surface and ground water. The implementation of various activities in areas near watercourses can affect the chemical and ecological state of surface waters. The indicator must be assessed in accordance with the Water Framework Directive. The chemical condition represents the loading of surface waters in relation to the content of priority and priority hazardous substances. These substances include e.g., atrazine, benzene, cadmium, mercury, carbon-tetrachloride, etc. Ecological status is an expression of the quality of the structure and functioning of aquatic ecosystems associated with surface waters. The assessment is based on biological elements of quality, general physico-chemical elements and hydro-morphological elements that support biological elements of quality and special pollutants that are released in the water environment. The chemical status of groundwater is determined on the basis of the following criteria: - exceeding the quality and limit quality standards, the effects of salt water penetration or other intrusions into the groundwater, - the concentration of pollutants that cause the deterioration of the ecological and chemical status of the surface and the groundwater and have a harmful effect on the water and terrestrial ecosystems that are directly dependent on them. The quantitative status reflects the degree of impact on the groundwater body due to direct and indirect groundwater abstraction.

SEA area	General Environmental Objectives	Specific Environmental objectives	Proposed Indicators	Justification
		SE 04.2 Sustainable use of water	Amount of used water	Implementation of groundwater abstraction measures may affect existing water users. Some other measures may indirectly affect water use. Monitoring of water abstraction is done based on the acquired water right in the form of a water permit and on the basis of records of payment of water fees.
		SEO 04.3 Protection and sustainable use of agricultural and forest land	Areas of agricultural land	INECP's measures may affect the extent of agricultural land and forests due to the planned implementation of various infrastructural interventions and the land use itself due to the planned use of wood and plant biomass. INECP also includes measures that aim to reverse the loss of forest cover through sustainable forest management, including protection, restoration, afforestation and reforestation, and increase efforts to prevent forest degradation and measures that contribute to the development of a more sustainable agriculture.
			Soil acidification	Based on the data, information and analysis from the Report on the State of the Environment in the Republic of Serbia in 2020, the following conclusions are drawn: "The highest emitted amounts of sulphur oxides, nitrogen oxides and suspended particles in 2020, as in previous years, come from thermal energy plants, chemical, mineral and food industries. The most significant contribution to the total amount of emitted acidifying gases in 2019 was made by: "Production and distribution of energy" for NO_x - 53.84 % and "Road traffic" - 19.24 %, and for SO_2 "Production and

SEA area	General Environmental Objectives	Specific Environmental objectives	Proposed Indicators	Justification
				distribution of energy" – 91.50 % and "Agriculture" about 90.72 % for NH_3. Emissions of acidifying gases were made according to the methodology of EMEP/EEA 2019. The share of PM_{10} emissions is the highest for "Heating power less than 50 MW and individual heating" about 51.37 %, "Energy use in industry and industrial processes" with 12.10 %.
Biodiversity	**EO 05** Protection of biodiversity and geodiversity	**SEO 05.1** Preservation of biodiversity	- The state of species and habitats - Qualified species status and qualified habitat types	Impacts on biodiversity are possible due to the implementation of various measures such as solar power plants, wind farms, the construction of HE and MHE and infrastructure for the transmission of electricity. In the absence of knowledge of specific locations and the size of individual interventions, impacts on the state of species, habitats and consequences for biodiversity will be assessed at the level of more detailed planning. Impacts due to hydropower plants, wind farms, road and rail infrastructure and electricity transmission infrastructure will be assessed at the level of detailed planning. INECP measures that contribute to climate change adaptation have to be taken into consideration, as they, among others, contribute to conserving biodiversity.
		SEO 05.2 Preservation of areas with nature protection status		Impacts on areas with nature protection status may be linked to activities such as wind farms, the construction of HE and MHE and infrastructure for the transmission of electricity. In the absence of knowledge of specific locations and the magnitude of individual interventions, it can only be estimated at the level of detailed planning.

SEA area	General Environmental Objectives	Specific Environmental objectives	Proposed Indicators	Justification
Cultural heritage	**EO 06** Protection of cultural and historical heritage	**SEO 06.1** Preservation of the state of cultural heritage sites and archaeological remains.	Number and preservation state of cultural heritage and archaeological sites	The implementation of INECP can have a direct or indirect, positive or negative impact on cultural heritage or archaeological remains. The selected indicators refer to the number of cultural heritage units that will actually be affected by the implementation of INECP, which will cause a change in the condition of the unit. Additional indicators refer to the determination of the state in terms of new construction, demolition of buildings and renovation of buildings, which affects the use of cultural heritage units, and therefore its condition.
Landscape	**EO 07** Protection of the landscape	**SEO 07.1** Preservation of exceptional landscapes, areas of national recognition and recognizable and typological characteristics of the landscape	- The number of outstanding landscapes and landscape areas of recognizable characteristics at the national level preserved state - Number of landscape subunits with a preserved condition	The implementation of INECP can have a lasting impact on the characteristics and integrity of Serbian landscapes. In addition to exceptional landscapes and landscape areas with recognizable characteristics, an indicator for defining the impact of INECP measures on the recognizable and typological characteristics of the landscape will be used. Changes in the state of the landscape include: the structural value that indicates the visual quality of the landscape, the degree of conformity of the morphological and typological characteristics of the landscape and land use, the composition of the landscape structure with combinations of natural and cultural elements, complexity within the same structural unit, the quality of the location of built objects.
Socio-economic aspects	**EO 08A** Stable economic and social environment	**SEO 08A.1** Ensure economic and social stability	- GDP growth rate - GDP per capita - Government sector debt	Indicators of sustainable development, which contain social and economic indicators have been taken up and are used to gauge contribution of INECP measures to the socioeconomic development of the society.

SEA area	General Environmental Objectives	Specific Environmental objectives	Proposed Indicators	Justification
	EO 08B Improvement in investments and infrastructure for climate change adaptation and mitigation		- Poverty rate, risk of poverty rate (based on poverty or poverty line defined nationally) - Energy poverty rate - Unemployment level	The total costs and method of financing INECP can have a significant impact on economic stability.
		SEO 08B.1 Increase of investments in energy infrastructure and environmental protection	Completion rate-trans-European transport and energy network	INECP influences the development of smart networks and connecting the state through investments in transport and energy networks and their management. The indicator shows the level of implementation of these networks in Serbia. The indicator is still not systematically monitored
		SEO 08B.2 Improvement of institutions and personnel for environmental protection and climate change monitoring	Digital index of economy and society	INECP is a challenge and an opportunity for entrepreneurship, research and development and thus can contribute to improving the competitiveness of the socially responsible economy. The indicators are listed in the Development Strategy of Serbia, which is monitored by the RZS.
		SEO 08B.3 Improvement of research, innovation and competitive employment		

4.4 EVALUATION CRITERIA

The evaluation criteria according to which the environmental impact assessment will be carried out are presented in the table below. Effects can be direct or indirect, significant or negligible, cumulative, synergistic, short-term, medium-term or long-term, permanent or temporary.

Table 4.4 Criteria for assessing the potential impacts

Evaluation Criterion	Symbol/unit	Characteristic	Explanation
Type	**++**	Impact strongly positive	▪ **Positive effect**. An impact representing an improvement in the baseline or introduces a positive change. ▪ **Impact strongly positive**. the action / objective is very likely to lead to significant growth / improvements, which implies large-scale / permanent benefits in achieving the environmental objective. ▪ **Impact possibly positive**. the action / objective can bring about small / moderate improvement in the short or long term, leading to large-scale temporary or medium-scale permanent benefits. even if the benefits appear to be temporary, it is highly unlikely the impact will be reversed to a negative one in the long run.
	+	Impact possibly positive	
	+/-	Impact mixed	▪ **Impact mixed**. The impact can be both positive and negative, as in the case where an action can upgrade some ecosystems or protected species, but at the same time damage some other non-indigenous ecosystems.

Evaluation Criterion	Symbol/unit	Characteristic	Explanation
	0	Neutral impact	▪ Impact neutral. The action / objective has no impact on the achievement of the environmental objective of the SEA either in the short or long term.
	--	Impact strongly negative	▪ **Negative impact**. An impact representing an adverse change from baseline or introducing an unwanted factor. In this case, appropriate measures-actions need to be undertaken to sufficiently reduce or even eliminate the foreseen negative impacts. ▪ **Strongly negative impact**: The action / objective can lead to significant damage / loss or a range of long-term negative effects, leading to large-scale permanent negative effects on the environmental parameter. The effects will be irreversible and extremely difficult to address.
	-	Impact possibly negative	▪ **Potentially negative impact**: The action / objective may result in partial destruction or loss both in the short and long term, leading to large-scale temporary or medium-scale permanent negative effects on the examined environmental aspect. The impact can be mitigated with through the implementation of appropriate measures.
	?	Impact unspecified	▪ **Impact unspecified**. It is uncertain or unpredictable whether the impact will be positive or negative on the environmental objective of the SEA.
Impact risk (Probability)	**0**	Negligible	▪ Impact is very unlikely to occur
	1	Low	▪ Impact may possibly occur
	2	Medium	▪ The impact is particularly likely to occur, i.e., it happens in most cases
	3	Certain	▪ The impact will definitely happen
	0	Negligible	

Evaluation Criterion	Symbol/unit	Characteristic	Explanation
Intensity	1	Low	▪ **Natural environment**. Intensity can be considered in terms of recipient sensitivity, as follows: ↘ *negligible* the impact on the environment is not detectable. ↘ *low*. the impact affecting the environment acts in such a way that physical functions and processes are not adversely affected, or if so, these natural functions are enhanced to a small extent. ↘ *Medium*. the affected environment is changing but physical functions and processes continue, although modified, or they have significantly improved. ↘ *High.* Physical functions or processes change to the point that they will be temporarily or permanently stopped, or in the event of a positive impact, they will be restored very close to their physical state in terms of functions and processes. ▪ **Man-made environment.** Intensity can be considered in terms of the ability of programme-affected individuals / communities to cope with or adapt to programme-induced adverse changes, to the extent that their quality of life / well-being will be enhanced as a result of socio-economic benefits. ↘ *Negligible*. there is no noticeable change in the quality of life of individuals. ↘ *Low*. Individuals / communities are able to cope / adapt to the negative effects with relative ease and maintain the quality of life / well-being they had before the impact. individuals will benefit marginally from the proposed activity and will experience a relatively small improvement in their quality of life / well-being. ↘ *Medium.* individuals / communities are able to cope / adapt to the negative effects with some difficulty and maintain the livelihoods they had before the impact but only with a degree of mitigation support. the quality of life / well-being of individuals is significantly improved as a result of the benefits. ↘ *High*. those affected will not be able to cope / adapt to the negative changes and continue to maintain the quality of life / well-being they had before the impact occurred. the quality
	2	Medium	
	3	High	

Evaluation Criterion	Symbol/unit	Characteristic	Explanation
			of life / well-being of individuals will be significantly improved.
Magnitude (spatial extent)	**L**	At the site	▪ Impacts limited within the project boundaries
	G	Local	▪ Impacts limited to area around the project site
	R	Regional	▪ Impacts affect environmental resources at regional scale or are felt at a regional level as determined by administrative boundaries, habitat type / ecosystem, etc.
	N/M	National/International-Transboundary	▪ Impacts affect environmental resources at national and international level or affect a nationally important area and / or having macroeconomic consequences.
Reversibility	**R**	Reversible impact	▪ Refers to the ability of an ecosystem or recipient to return to pre-impact status using its own resilience mechanisms
	NR	Non-reversible impact	
Duration	**1**	Short term	▪ Impacts that are expected to last only during the construction period
	2	Long term	▪ Impacts that will continue throughout the life of the project, but stop when the operation of the project is stopped
	3	Permanent	▪ Impacts that cause a permanent change in the affected recipient or resource (eg removal or destruction of the ecological habitat) and that last substantially beyond the life of the project
Cumulativeness / Synergy	**0**	Non-Cumulative / Synergistic impacts	▪ Impacts acting in conjunction with other implications (including those from concurrent or future activities of third parties) intended to affect own resources and / or recipients
	1	Cumulative / Synergistic impacts	

5 ASSESSMENT OF THE POTENTIAL ENVIRONMENTAL IMPACTS AND MEASURES TO REDUCE NEGATIVE IMPACTS ON THE ENVIRONMENT

5.1 EVALUATION OF LIKELY SIGNIFICANT EFFECTS OF THE INECP ON THE ENVIRONMENT

In the following sections, information is synthesized through a detailed methodological approach, to identify, assess and evaluate the potential significant impacts of the five dimensions of INECP on the environment, with regards to the environmental parameters and objectives identified.

The potential effects that may be caused by the implementation of the envisaged activities of the INECP, are presented in the following chapters.

It should be mentioned at this point, that for specific proposed projects/activities in the INECP, a separate Environmental & Social Impact Assessment Study (ESIA), or an appropriate Ecological Assessment Study will be required, in line with relevant Laws.

5.1.1 Guiding questions by environmental objective

The assessment is guided by questions (guiding questions) associated to each environmental parameter and objective, that will assist the discussion on likely significant impacts for each of the INECP's thematic areas.

Table 5.1. Guiding questions

1.	**Mitigation and resilience to climate change**
EQ1.1	▪ Is it expected that the INECP interventions will positively influence the degree of use of RES?
EQ1.2	▪ Will the INECP interventions support energy efficiency and a decrease of final consumption?
EQ1.3	▪ Will the INECP interventions lead to a decrease of energy consumption in the transport sector?

EQ1.4	▪ Will the INECP interventions promote circular economy, mitigating and increasing resilience to climate change?
***2.* Protection of human health**	
EQ2.1	▪ Will the interventions of INECP lead to a reduction of polluting air emissions?
EQ2.2	▪ Will the interventions of INECP directly or indirectly affect the supply of drinking water to the population?
EQ2.3	▪ Will the INECP interventions reduce noise emissions and vibrations ?
EQ2.4	▪ Will the interventions contained in the INECP directly or indirectly lead to increased electromagnetic radiation exposure of the population?
EQ2.5	▪ Will the INECP interventions reduce waste generation and promote adequate treatment and disposal of waste affecting the health of the population?
***3.* Prevention and management of natural and other disasters**	
EQ3.1	▪ Will INECP interventions improve safety from floods and risk of fire?
***4.* Protection of surface and underground water, agricultural and forest land**	
EQ4.1	▪ Are INECP interventions expected to protect the aquatic environment, including coasts, from pollution, or even improve the quality characteristics of surface and groundwater and the marine environment?
EQ4.2	▪ Do INECP interventions support the rational use of water?
EQ4.3	▪ Will the interventions included in the INECP directly or indirectly lead to the preservation of the quantity and quality of useful lands and their rational use, and will they directly or indirectly lead to a reduction of pollution and land degradation?
***5.* Protection of biodiversity and geodiversity**	
EQ5.1	▪ Are infrastructure and/or activities of the INECP expected to lead to a loss of biodiversity and geodiversity directly or indirectly?
EQ5.2	▪ Are infrastructure and/or activities of the INECP expected to lead to the degradation of areas with nature protection status?
***6.* Protection of cultural and historical heritage**	
EQ6.1	▪ Are infrastructure and/or activities of the INECP expected to directly or indirectly lead to the degradation of monuments, historical objects and archaeologically protected?

***7.* Landscape protection**	
EQ7.1	▪ Will there be a change in the natural, cultural and aesthetic character of the landscape, areas of national recognition and typological characteristics of the landscape as a result of INECP interventions?
8 A. Stable economic and social environment	
EQ8.1	▪ Will the interventions covered by INECP directly or indirectly contribute to economic and social stability as well as sustainable population growth?
8B. Improving investments and institutions for climate change adaptation and mitigation	
EQ9.1	▪ Will INECP interventions contribute to the increase of investments in energy infrastructure and environmental protection?
EQ9.2	▪ Is it expected that the institutions and personnel in the field of environmental protection and climate change monitoring will be improved as a result of INECP interventions?
EQ9.3	▪ Will INECP interventions improve research, innovation and lead to competitive employment growth?

5.1.2 Detailed Assessment of Likely Environmental Effects

This section presents the assessment of the likely impact of the selected actions and measures under the five dimensions of INECP on the environment. The approach rests on examining whether and how an action/measure affects the environment through the guiding questions listed in the previous section. The identified significant impacts per environmental objective are presented, as they emerged from the analysis. Where potential negative impacts are identified, measures and actions are proposed to mitigate or cancel the negative effects.

Recognizing the main objective of a Strategic Assessment, which includes the protection of the environment and human health, in the context of economic development and ensuring the implementation of a sustainable development strategy, it is necessary that the outcome of the evaluation of the impact assessment of INECP indicates the potential negative impacts of the implementation of planning solutions (measures, policies) and suggests measures to mitigate or avoid negative impacts.

Today's main challenges in the field of environmental protection cannot be solved in isolation. The following priority areas (climate change, human health, use of natural resources and waste, nature and biodiversity, cultural and archaeological heritage, landscape and socio-economic aspects) are connected by a series of direct and indirect links.

Due to the recognition of diffuse pressures from different sources, we focused on the integration of problems related to the environment within the policies of the thematic areas (dimensions) of INECP. Requirements for a comprehensive assessment of the impact of INECP dimensions on the environment set minimum requirements for assessing the impact of INECP implementation on the specified priority areas of the environment.

Considering the contribution to green development, we have proposed a set of objectives that are not directly related to individual elements of the environment but are related to sustainable development.

5.1.2.1 Environmental Objective "Mitigation and resilience to climate change"

5.1.2.1.1 Environmental specific objective " Increased share of RES energy in gross final energy consumption to at least 33.6 % in 2030 "

Evaluation of the impact of INECP implementation

Within the INECP, the national objective for the penetration of RES was specified. More precisely, the share of RES in the gross final energy consumption should be at least 33.6 % in 2030. Additional objectives have been set for the share of RES in the gross final electricity consumption to reach at least 45.2%, the share of RES in covering heating and cooling demand to reach 41.4% and the share of RES in the transport sector to reach 6.8% in alignment with the relevant EU calculation methodology.

The stated goals for RES penetration are directly related to the evolution of final consumption, which requires the achievement of relevant energy efficiency goals. Obviously, the key pillar for fulfilling the national goal for the penetration of RES is the contribution of RES in electricity consumption, which represents the greatest requirement for the timely and efficient implementation of planned policies and measures.

Achieving the stated objectives requires a significant increase in the installed capacity of RES for electricity generation, resulting in an increase in installed capacity of around 500 % for most of the relevant technologies (i.e., wind energy and photovoltaic energy). The goal is assessed as realistic, considering both the technical and economic potential, as well as the increased interest of investors in Wind and PV installations, which is evident by the large number of applications.

Electrification and integration of final consumption sectors are also promoted in order to increase the share of RES in final energy consumption. Initially, the gradual electrification of the transport sector represents a major challenge until 2030. More precisely, the significant penetration of electric vehicles is expected to significantly affect several INECP areas. The goal is to make this breakthrough the most profitable approach for the national economy, while ensuring timely preconditions for the electrification of the transport sector, such as the simultaneous development of the charging infrastructure and the adoption of the regulatory framework.

Moreover, the merging of sectors will contribute to the maximization of RES in different end uses and the electrification of different end uses is clearly an essential component in achieving this goal. The role of heat pumps, together with energy storage systems and self-consumption schemes, is critical to the fulfilment of sector coupling. Similarly, blending hydrogen or biomethane into the natural gas grid can also contribute to sector integration.

An objective has also been set to promote RES technologies in buildings through self-consumption and net metering schemes. More specifically, the installed capacity of the RES technologies for electricity production (mainly rooftop PV systems) are expected to reach up to 0.5 GW in 2030, being capable of covering approximately 5% of the electricity consumption in the residential sector.

New innovative RES technologies for electricity production are proposed to be promoted within INECP through pilot projects to evaluate their efficiency, such as: use of hydrogen production, small wind turbines, etc.

The use of RES to cover heating and cooling needs will be achieved mainly through the mass installation of heat pumps (approximately 7 GW), while the role of solar thermal systems, geothermal energy and biomass is also important.

Furthermore, further use of RES in district heating networks will be achieved mainly through biomass (2.7 ktoe), while the gradual exploitation of other RES, such as biomethane, hydrogen and geothermal energy, is foreseen.

Finally, the contribution of electric vehicles is expected to be significant for the further promotion of RES. It should be noted that approximately 45 thousand electric vehicles (passenger and light) will be registered by 2030. Last but not least, the contribution of biofuels will remain, with a particular increase in the share of advanced biofuels by 2030 (49 ktoe).

i. Current share of renewable energy in gross final energy consumption and in different sectors (heating and cooling, electricity and transport) as well as by technology in each of these sectors

As shown in **Error! Reference source not found.**, the gross electricity production remained almost stable in 2020, compared to 2010 at about 3.3 Mtoe, despite several fluctuations within the period. Solid fossil fuels and RES (mainly hydro power) are the major sources contributing substantially to the gross electricity production over the last decade, by 65.7% and 33% in 2010 and by 70% and 29% in 2020, respectively.

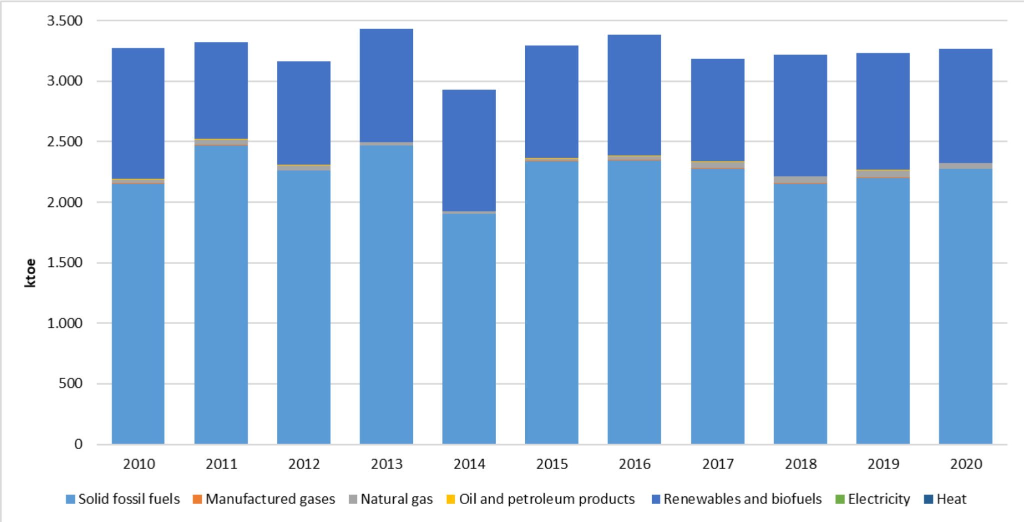


Figure 5.1: **Gross production of electricity during 2010-2020 (Source: Eurostat, 2023)**

Furthermore, the gross heat production declined by 4.8% between 2010 and 2020; from 905.0 ktoe in 2010 to 861.1 ktoe in 2020, as shown in the figure below**Error! Reference source not found.**. Natural gas and solid fossil fuels contributed substantially to the gross heat production over the last decade, by 48.88% and 16.88% in 2010 and by 66.09% and 17.01% in 2020, respectively.

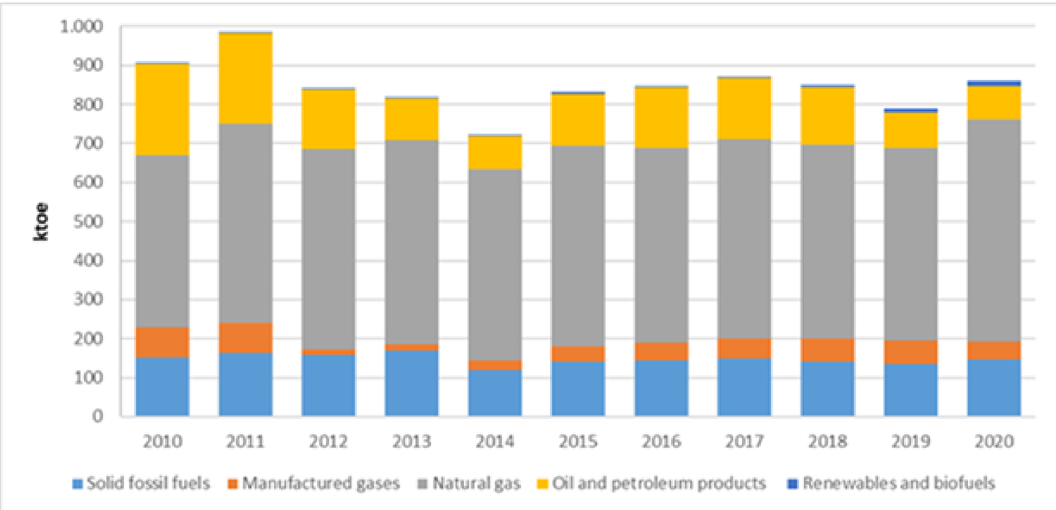


Figure 5.2: **Gross heat production during 2010-2020 (Source: Eurostat, 2023)**

As illustrated in the following figure, the share of RES in gross electricity consumption increased during 2010-2020 from 28% in 2010 to 31% in 2020, while the share of energy from RES as a percentage of gross final energy consumption also increased from 19.8% in 2010 to 26.3% in 2020.

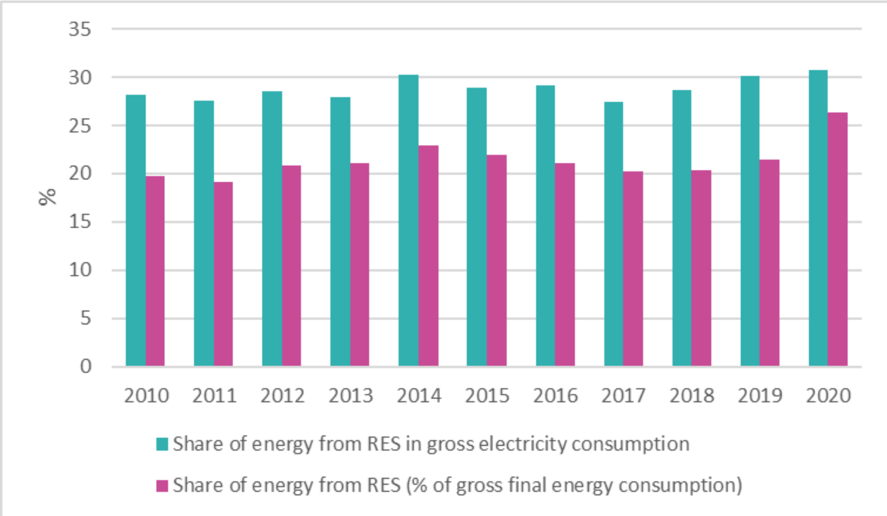


Figure 5.3: Share of energy from RES during 2010-2020 (Source: Eurostat, 2023)

ii. Development projections with additional policies and measures at least until 2040 (including for 2030)

The share of RES in gross final energy consumption in scenarios S and S-N is equal to 33.6% in 2030 and approximately 62% in 2050 for scenario S and about 60% for scenario S-N. This means a 35% in scenario S and a 33% in scenario S-N higher penetration of RES in 2050 respectively, compared to the WEM scenario (Figure 5.4) and a respective 6% higher RES penetration in 2030 for both scenarios.

The penetration of RES in the three sub-targets is higher in 2030 for both the examined scenarios S and S-N compared to WEM scenario by:

- 45% in the electricity generation sector as the result of the installation of additional PV and wind power plants (Figure 5.5).
- 3.2% in the transport sector (without multipliers) due to the increased penetration promotion of electrification (Figure 5.6).
- 41% in the heating sector, mainly as the result of the installation of heat pumps and the promotion of other type of RES in buildings, such as solar thermal and geothermal energy (Figure 5.7).

In 2050, the respective RES share in scenarios S and S-N is considerably higher than in the WEM scenario mainly due to the initiation of additional measures for the promotion of RES by:

- 94% and 87% in the electricity generation sector in scenarios S and S-N respectively.

- 45% and 49% in the transport sector (without multipliers) in scenarios S and S-N respectively.
- 39% in the heating sector in both scenarios S and S-N.

It should be noted that scenario S leads to higher deployment of RES in gross final energy consumption by 2050 due to the increased promotion of RES in electricity generation and transport sector.

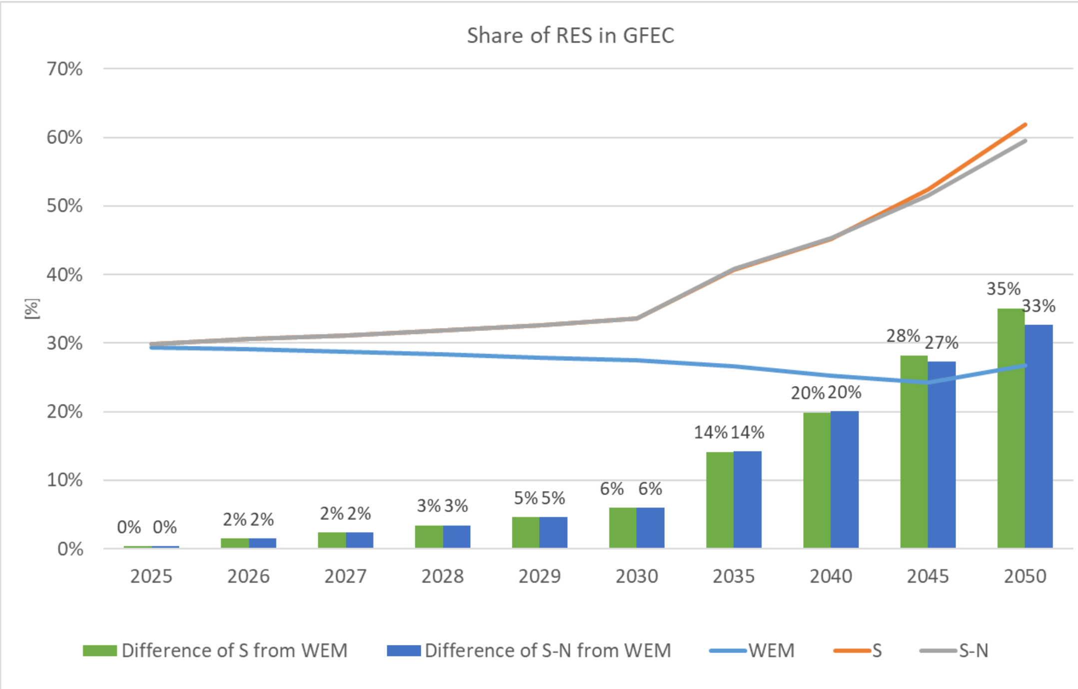


Figure 5.4: Share of RES in gross final energy consumption during 2025-2050

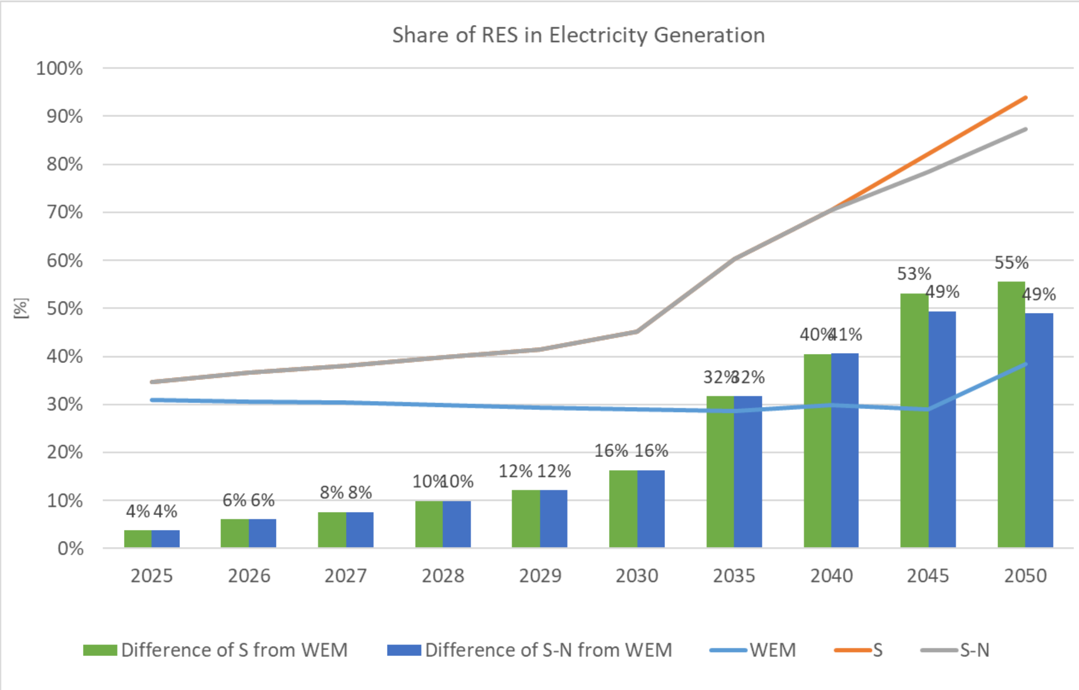


Figure 5.5: Share of RES in total electricity production during 2025-2050

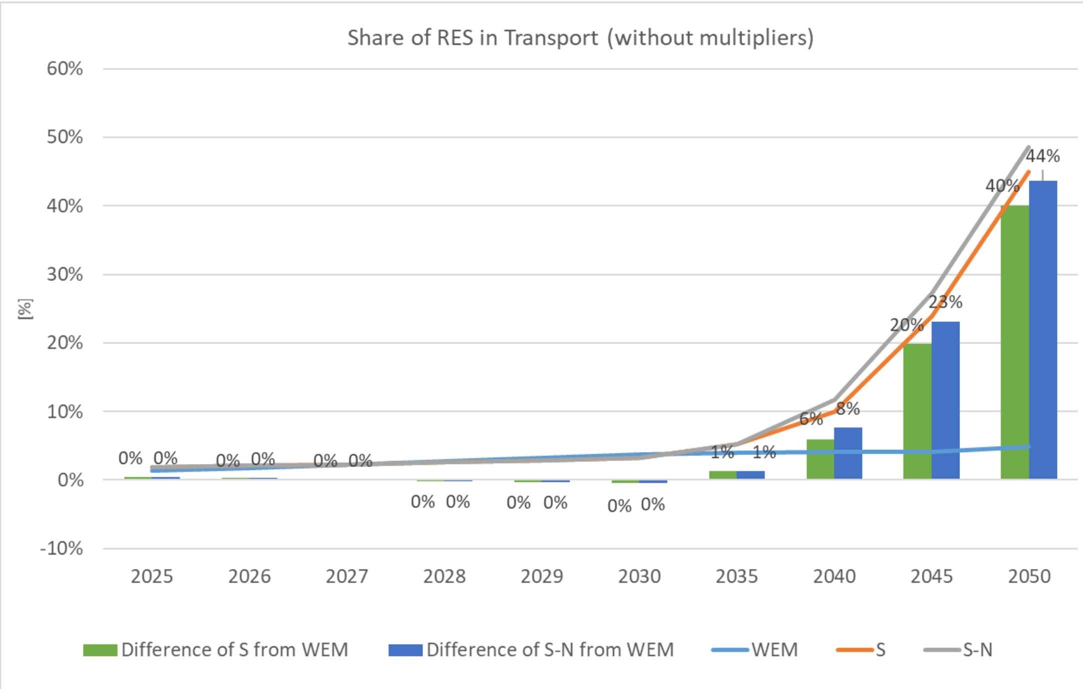


Figure 5.6: Share of RES in Transport (without multipliers)

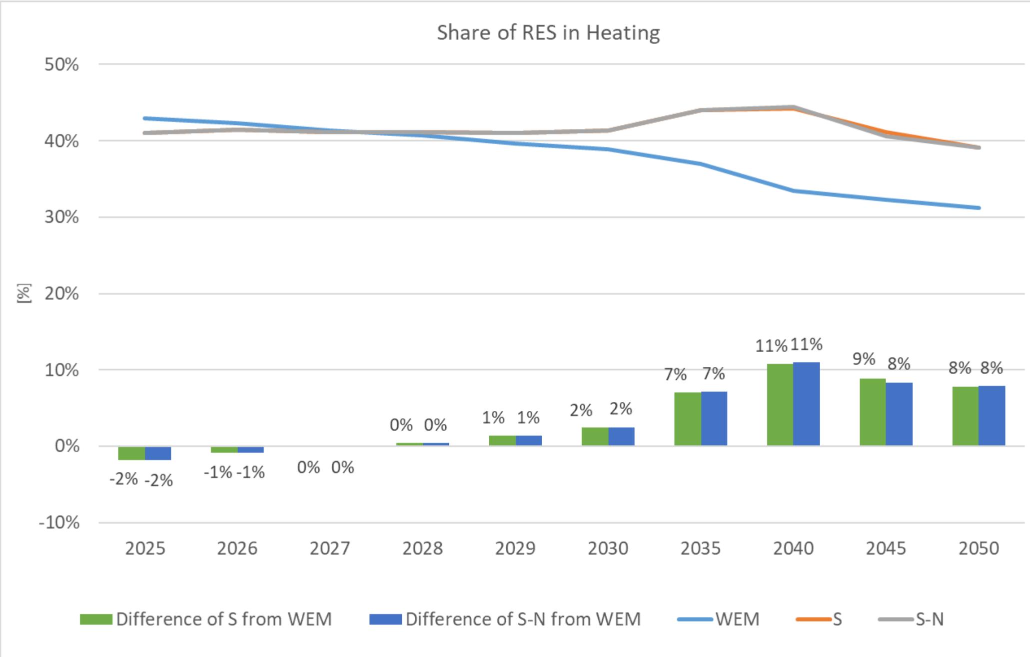


Figure 5.7: Share of RES in Heating

In WEM scenario, the total installed capacity for electricity production is projected to increase from 9 GW in 2025 and 10 GW in 2030 to 13 GW in 2050, as presented in Figure 5.8. The expected increase is mainly attributed to the penetration of RES technologies for electricity generation, which generally have a lower utilization or capacity factor than conventional technologies and therefore require more capacity installed than conventional power plants for the same electricity production.

Similarly, in both scenarios S and S-N, the total installed capacity for electricity production is expected to rise from 10 GW in 2025 and 11 GW in 2030 to about 36 GW in 2050.

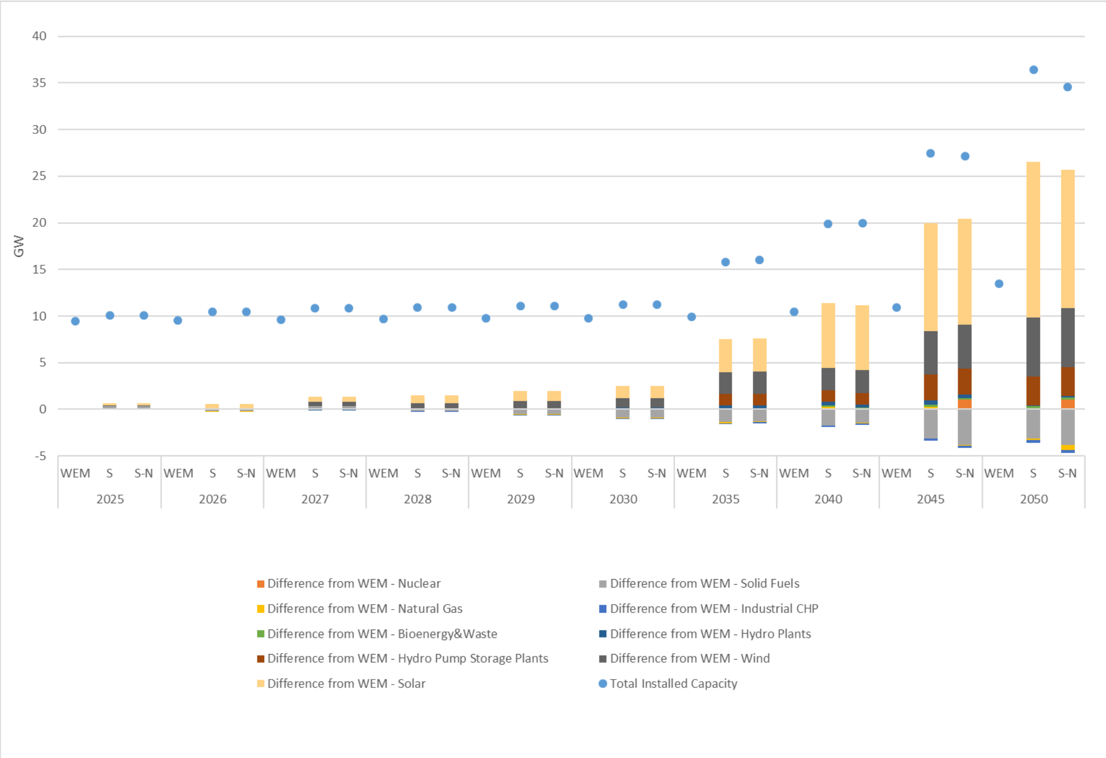


Figure 5.8: Installed capacity by technology in the power sector during 2025-2050

In WEM scenario, the total installed RES capacity is projected to reach 4 GW in 2025 and 2030 and 7 GW in 2050 (Figure 5.9). Similarly, in both scenarios S and S-N, the total installed RES capacity is expected to rise from 6 GW, excluding hydro pump storage plants, in 2030 to about 30 GW in 2050. Solar and wind are anticipated to have the largest contribution in all scenarios in 2030 and 2050.

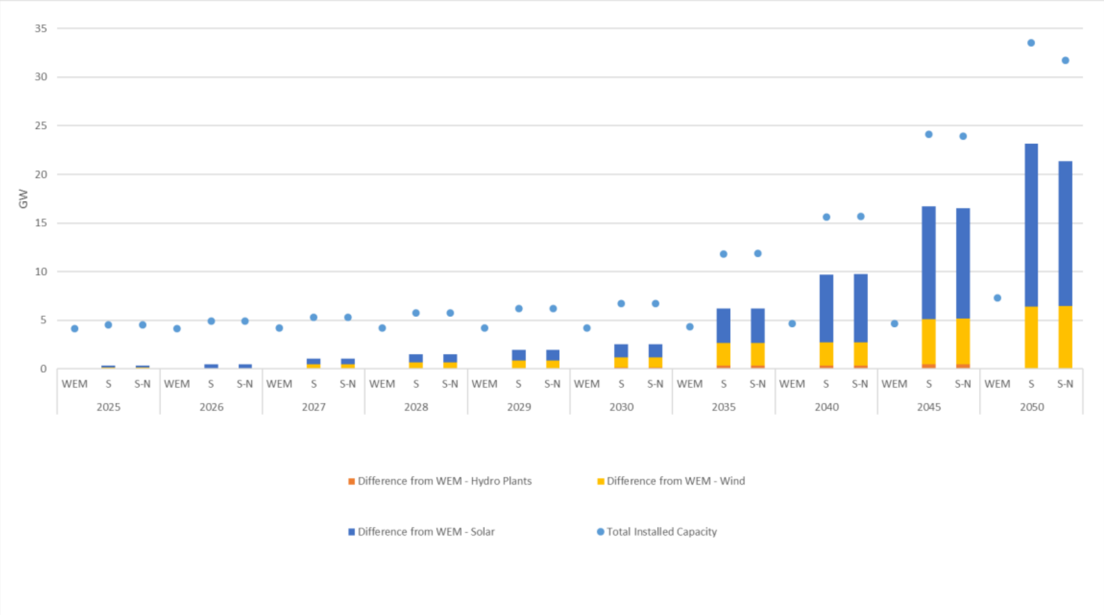


Figure 5.9: Installed RES capacity by technology during 2025-2050

A detailed analysis of the operation of the power system under the S scenario, on an hourly basis was performed for two milestone years (2030 and 2040) using the ANTARES software. For 2030 the results indicate that the unsupplied energy is practically zero, which means that the generation adequacy of the system is robust. Furthermore, there is no spilled energy (no curtailment of electricity generation from variable renewables), therefore the system is flexible enough to accommodate the modelled variable RES capacities, at least at the Day-Ahead market level. The analysis for 2040, indicates that unsupplied energy is zero, signifying generation adequacy of the system. There is some spilled energy in 2040 but the level is negligible and does not exceed 0.01% of the total available wind and solar generation. This means that the system is flexible enough to accommodate the modelled variable RES capacities for 2040, at least at the Day-Ahead market level.

In WEM scenario, the non-road RE electricity consumption in transport is expected to reach 14 ktoe in 2030, while it will stand at 11 ktoe in both scenarios S and S-N over the same year (Figure 5.10). In 2050, an increase of the non-road RE electricity consumption in transport is anticipated in WEM scenario, reaching 19 ktoe, compared to scenarios S and S-N, where it will significantly rise to 41 ktoe in scenario S and 38 ktoe in scenario S-N respectively. The increase is even higher for road RE electricity consumption, especially for scenarios S and S-N, where a rise from 13 ktoe in 2030 to 415 ktoe in scenario S in 2050 and from 13 ktoe in 2030 to 422 ktoe in 2050 in scenario S-N is expected.

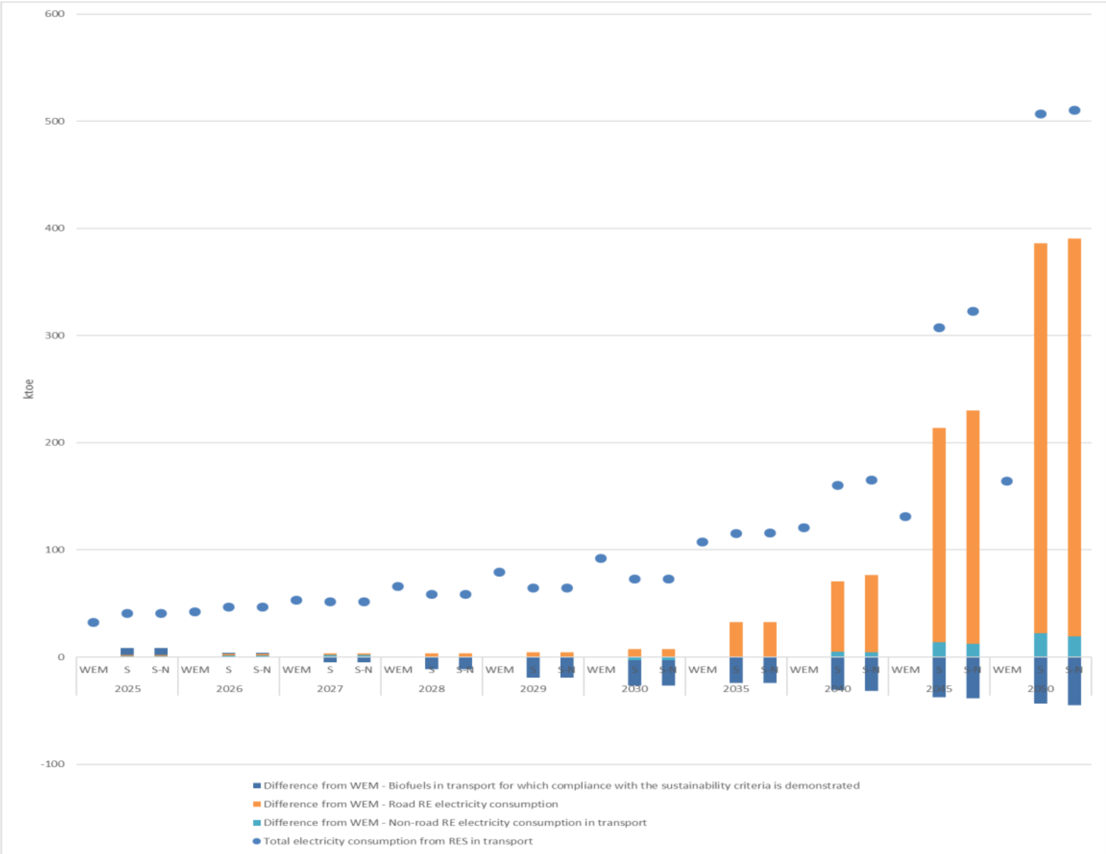


Figure 5.10: Consumption of electricity from RES in transport during 2025-2050

In WEM scenario, the total installed capacity in the district heating sector is projected to reach 8 GW in 2030 and 6 GW in 2050. Similarly, it will reach 7 GW in 2030 and about 6 GW in 2050 in scenarios S and S-N (Figure 5.11). Natural gas and oil products are anticipated to have the largest contribution in all scenarios in 2030 and 2050.

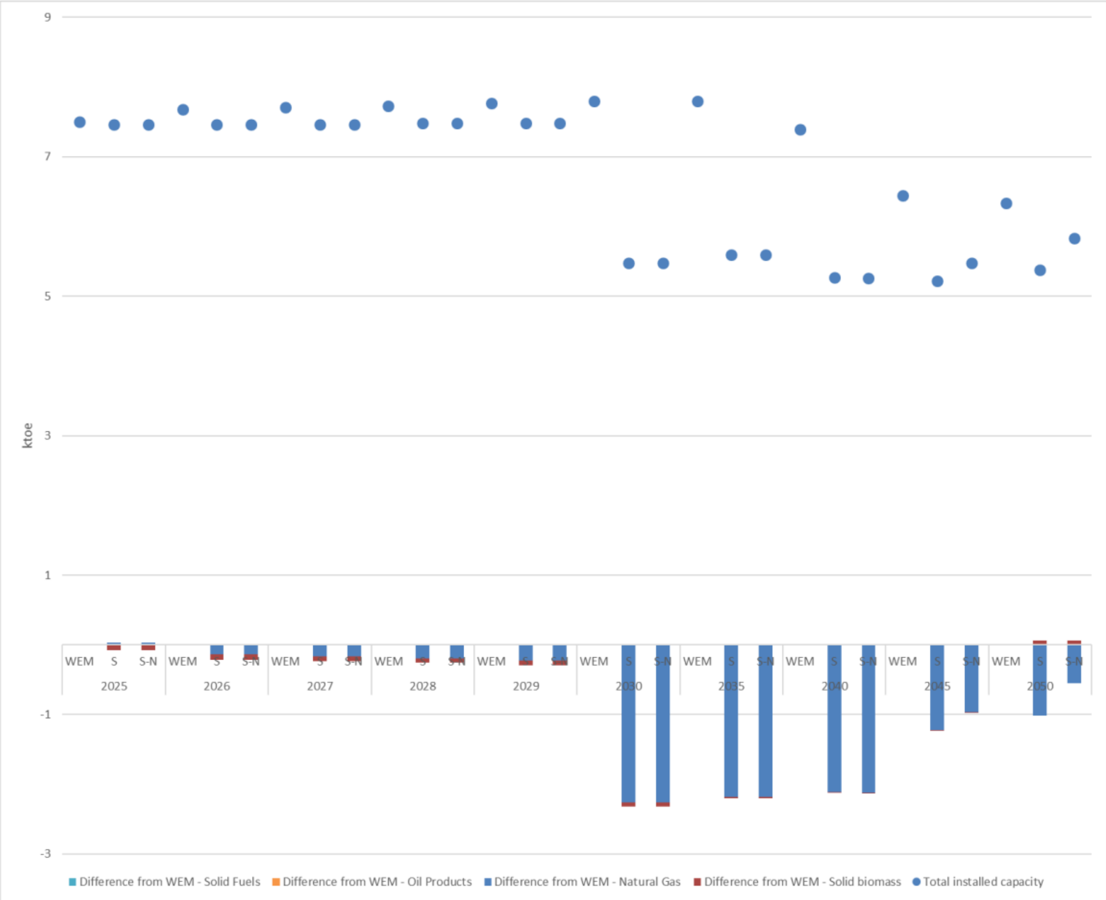


Figure 5.11: Installed capacity by technology in the district heating sector during 2025-2050

The following issues were considered:

1 - intense increase in the share of renewable energy sources in gross final energy consumption

2 - a moderate increase in the share of renewable energy use in gross final energy consumption

3 - maintaining the participation of renewable energy sources in the gross final energy consumption

Based on the above and as indicated in Error! Reference source not found. **it can be concluded that the INECP dimensions and the proposed scenario will contribute positively to the environmental specific objective " Increased share of RES energy in gross final energy consumption to at least 33.6 % in 2030" (overall rating ++ Strongly positive).**

Table 5.2: Identification of the characteristics of the significant impacts of the implementation of INECP on the environmental specific objective " Increased share of RES energy in gross final energy consumption to at least 33.6 % in 2030".

Environmental Objective	EO 01. Mitigation and resilience to climate change	Impact characterization						
		Type	Impact risk (Probability)	Intensity	Magnitude	Reversibility	Duration	Cumulative ness / Synergy
Specific Objective	**SEO 01.1 " Increased share of RES energy in gross final energy consumption to at least 33.6 % in 2030"**							
Impact assessment question	EQ1.1. Is it expected that the INECP interventions will positively influence the degree of use of RES?							
Dimensions	**GHG Emissions and Reduction**	++	2	2	N/M	NR	2	1
	RES	++	3	2	N/M	NR	2	1
	Energy efficiency	++	2	2	N/M	NR	2	1
	Energy security	0	-	-	-	-	-	-
	Internal energy market	+	2	1	N/M	NR	2	1
	Research, innovation and competitiveness	+	2	1	N/M	NR	2	1
Overall assessment	++ strongly positive							

5.1.2.1.2 Environmental specific objective " Increased energy efficiency and reduction of final consumption "

Evaluation of the impact of INECP implementation

In the "Energy efficiency" dimension, INECP sets national objectives and contributions to energy efficiency until 2030.

A significant objective within the INECP is to improve energy efficiency by limiting final energy consumption to a level that does not exceed 9.7 Mtoe in 2030. Primary energy consumption was reduced in 2030 compared to 2020 by 3 %, which is equal to 14.7 Mtoe.

The additional objective of saving energy is determined in accordance with the provisions of Article 7 of Directive 2012/27/EU. Moreover, specifically, 506 ktoe of cumulative final energy savings should be delivered through the implementation of energy efficiency measures in the period 2024-2030.

The need to renovate the existing building stock is undeniable, leading not only to significant energy and cost savings, but also to the simultaneous improvement of comfort, safety and health in renovated buildings. The renovation rates, estimated within the framework of the Long-term Strategy for Encouraging Investments in Renovation of the National Building Stock of the Republic of Serbia for the case of the residential and non-residential buildings respectively, have been taken into consideration within the framework of the INECP until 2030 to ensure sufficient renovation of the building stock. Consequently, 131 thousand dwellings and 7681 thousand m^2 non-residential buildings (excluding public buildings) will be renovated until 2030 boosting construction industry through high added value technologies and enabling the covering of the thermal needs of the end-users with lower energy costs. It should be noted that the exemplary role of the public sector will be enabled by the renovation of public buildings as 1, 026 thousand m2 public buildings are expected to be renovated.

Finally, the implementation of planned policies and measures among end users to improve energy efficiency requires the creation of effective financing mechanisms in order to increase and maximize the current level of private influence. The active involvement of the financial sector and the promotion of innovative financing instruments, including the promotion of energy performance contracts and energy services, are critical parameters for achieving this goal.

i. Current consumption of primary and final energy in the economy and by sector (including industry, housing, services and transport)

Over 2010-2020, the gross inland energy consumption remained almost constant (from 15.6 Mtoe in 2010 to 15.99 Mtoe in 2020), recording only a sharp and temporary reduction in 2014 due to the temporary GDP decline. As shown in the figure below, the solid fossil fuels and oil and petroleum products had a dominant role in the gross inland consumption, with respective shares of 50% and 25% in 2010 and 50% and 23% in 2020, while the penetration of RES and biofuels, as well as natural gas was lower at about 16% and 12% in 2020 correspondingly.

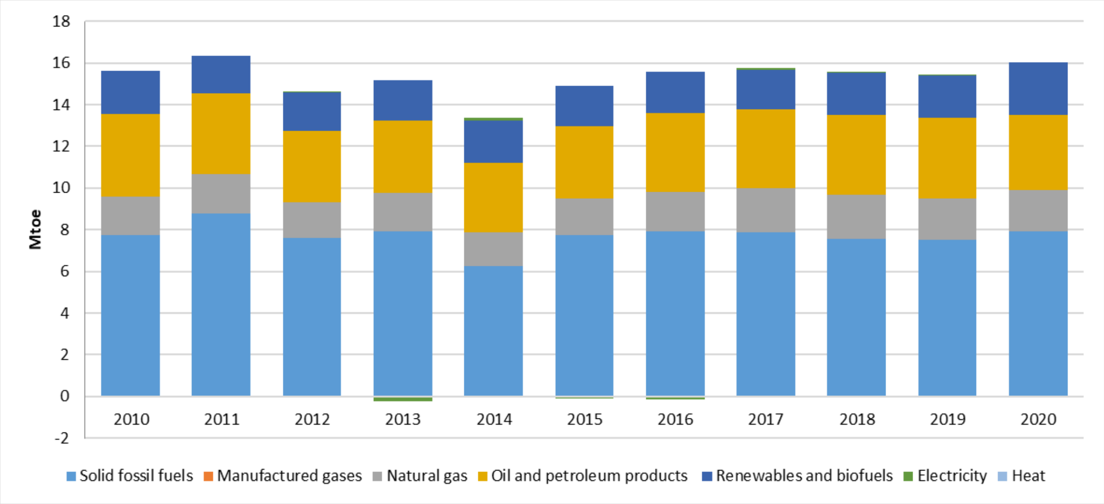


Figure 5.12: **Gross inland consumption during 2010-2020 (Source: Eurostat, 2023)**

The primary and final energy consumption were stable at about 15.0 Mtoe and 9.0 Mtoe respectively during 2010-2020. More specifically, the primary and final energy consumption increased from 2010 to 2011 and then a downward trend was recorded by 2014. Since 2015, a slight increase was experienced until 2020; from 14.2 Mtoe in 2015 to 15.2 Mtoe in 2020 for primary energy consumption and from 8.2 Mtoe in 2015 to 9.110 Mtoe in 2020 for final energy consumption. It should be noted that the primary energy consumption is derived from the gross inland consumption, excluding all non-energy use of energy carriers (e.g. natural gas used not for combustion but for producing chemicals).

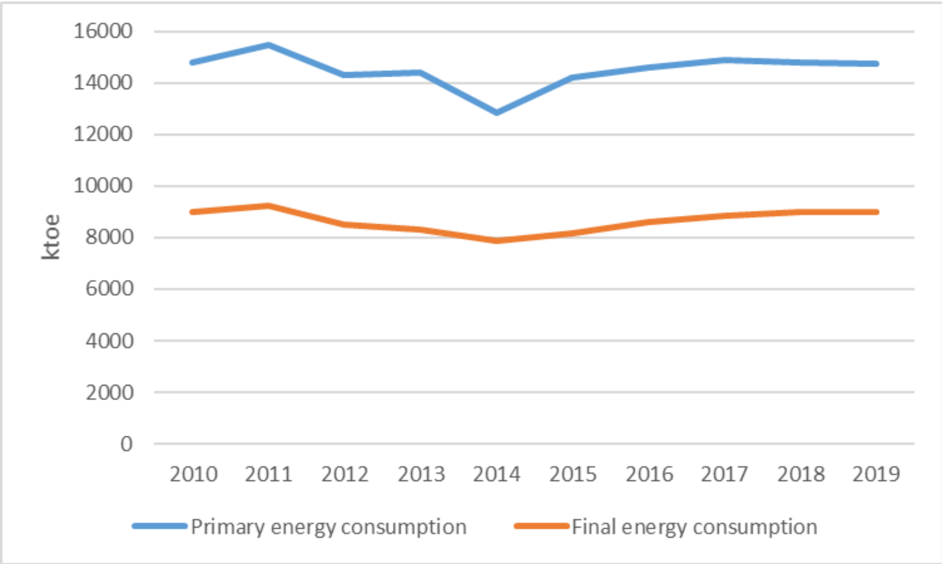


Figure 5.13: Primary and final energy consumption in the period 2010-2020 (Source: Eurostat, 2023)

As shown in Figure 5.14, the final energy consumption decreased by 0.5% in the period 2010-2020. More specifically, the final energy consumption was reduced in the period 2012-2014 after a temporary increase in 2011, while an increasing trend has been observed from 2015 to 2020. The shares of the different energy carriers remained almost identical in 2020 in comparison with 2010.

The fact that the consumption of primary and final energy remained relatively constant despite the significant increase in GDP is an indicator of the contribution of improved technologies and equipment to energy efficiency in all end-use sectors.

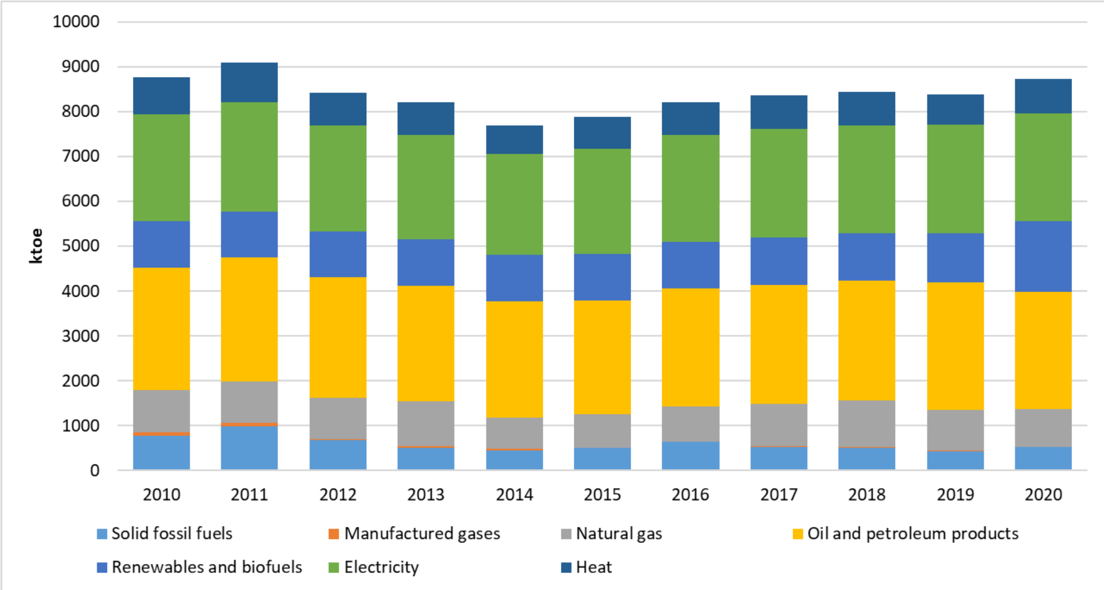


Figure 5.14: Final energy consumption by fuel in the period 2010-2020 (Source: Eurostat, 2023)

In 2020, the residential sector was responsible for 40% of the final energy consumption, while the industrial and transport sectors had shares equal to 23% and 25% respectively, as shown in Figure 5.15. The final energy consumption of the industrial and transport sectors decreased in the period 2010-2020 by 17% and 1.5% respectively, while the final energy consumption of the residential sector increased by 13.3% over the same period. The contribution of the services and agricultural sectors to the final energy consumption was considerably lower in the period 2010-2020 compared to the other end-use sectors.

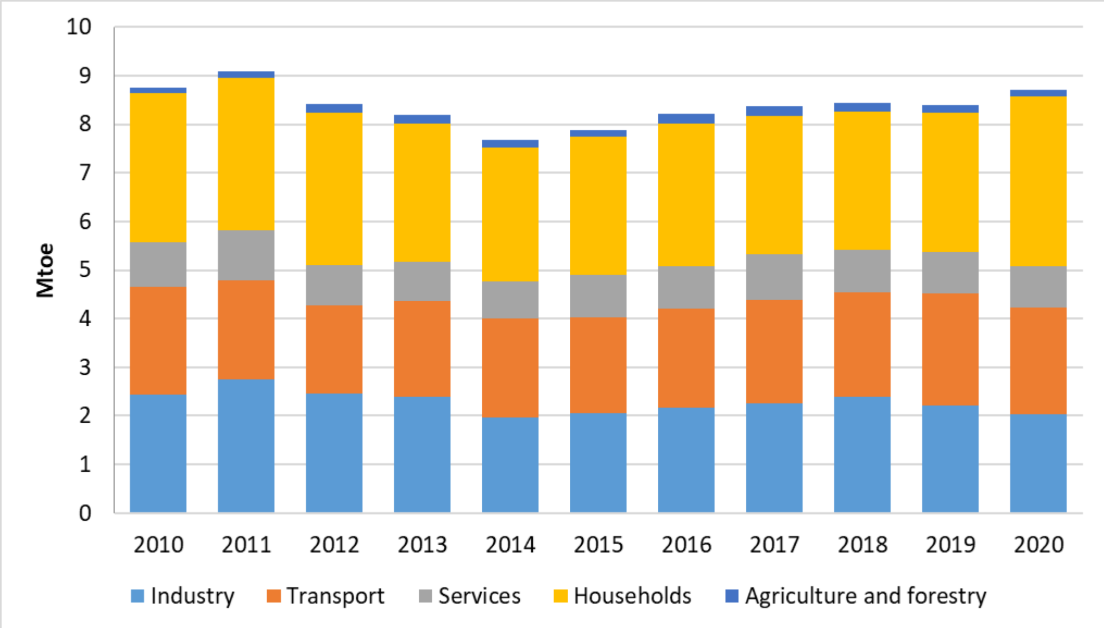


Figure 5.15: Final energy consumption by end-use sector during 2010-2020 (Source: Eurostat, 2023)

ii. Current potential for the application of highly efficient cogeneration and efficient district heating and cooling

The district heating network losses will remain the same at the level of 9.4% in 2030 and 2050. District cooling is not considered as an option in the period until 2030.

High efficiency gas-fired cogeneration units are considered as an option for the district heating systems together with biomass and biogas fired units. The penetration in the WEM scenario is expected to be limited but in the scenario with addition measures, there is a potential of gas fired CHP covering up to 3% of total district heat production and a potential of heat produced in bioenergy CHPs to cover up to 5% of the total heat generation in DH systems.

iii. Projections that take into account additional policies, measures and energy efficiency programs as described under 1.2. ii) for primary and final energy consumption for each sector at least until 2040 (including 2030)

In 2030, the primary and the final energy consumption are equal to 14.7 Mtoe and 9.7 Mtoe respectively in scenarios S and S-N leading to lower levels by 17% (Figure 5.16) and 9% (Figure 5.17) compared to the WEM scenario. The reduction in the primary and final energy consumption is mostly due to the implementation of additional policies and measures for the promotion of energy efficiency and RES. The difference in the final energy consumption among

WEM and scenarios S and S-N is distributed on average among the residential (36%), industry (27%) and transport (26%) sectors in 2030.

In 2050, the primary energy consumption is equal to 11.5 Mtoe and 12.5 Mtoe in scenarios S and S-N respectively leading to reduced levels by 40% and 35% compared to the WEM scenario. The same tendency is observed for the case of final energy consumption leading to approximately identical level (9.5 Mtoe presenting 27% reduction compared to WEM scenario). The reduction in the primary and final energy consumption is mostly due to the intensified implementation of additional policies and measures for the promotion of energy efficiency and RES.

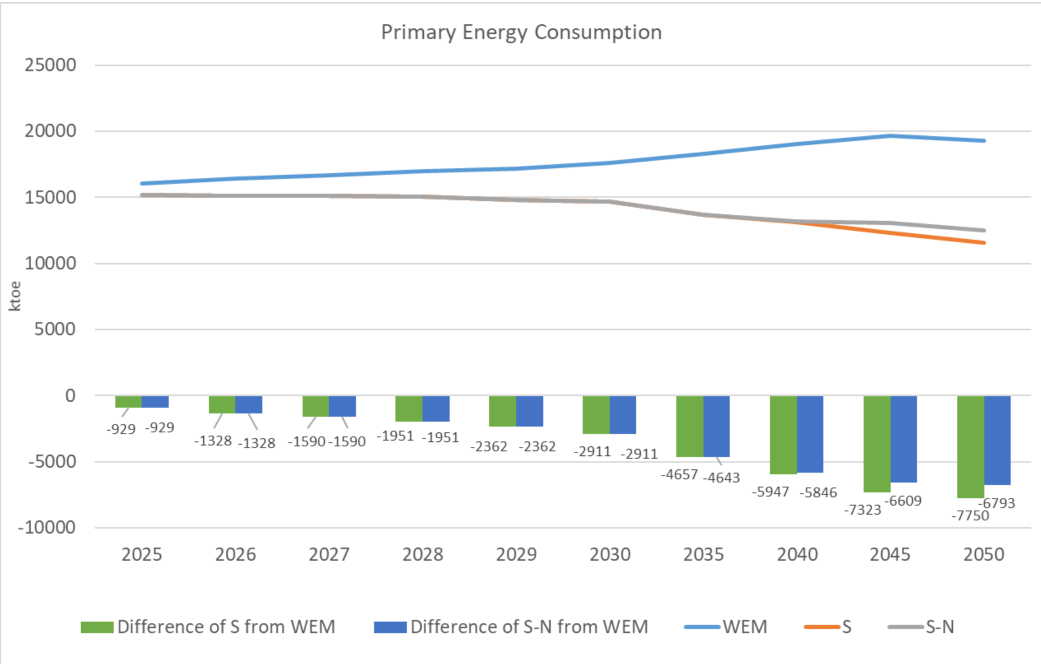


Figure 5.16: Primary energy consumption during 2025-2050

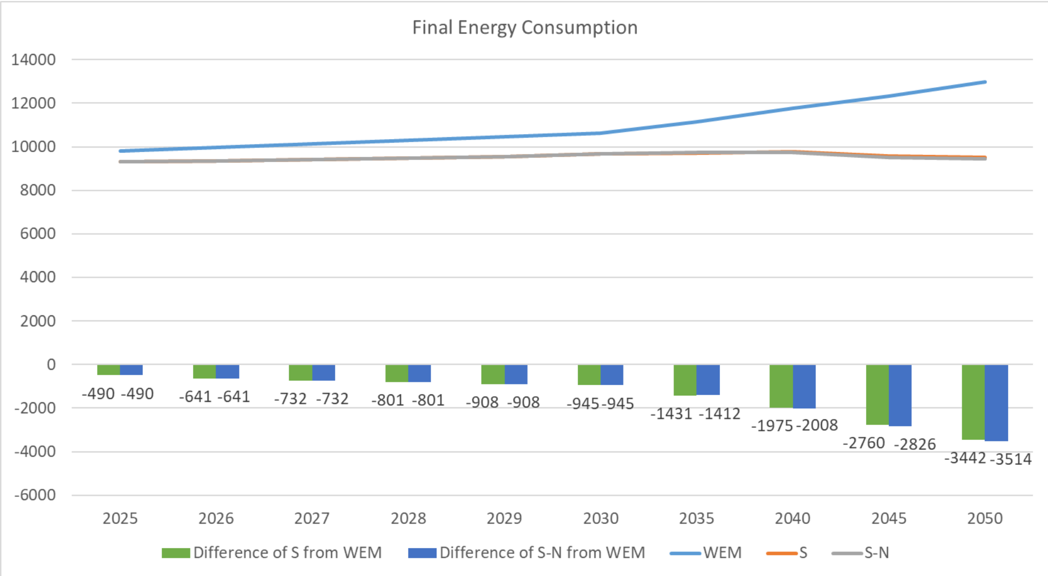


Figure 5.17: Final energy consumption during 2025-2050

In WEM scenario, the final energy intensity is equal to 0.17 toe/000 Euro in 2030, almost similar to 0.16 toe/000 Euro, which corresponds to scenarios S and S-N over the same year (Figure 5.18). Similarly, the final energy intensity is equal to 0.12 toe/000 Euro in 2050 in WEM scenario, compared to about 0.09 toe/000 Euro in scenarios S and S-N.

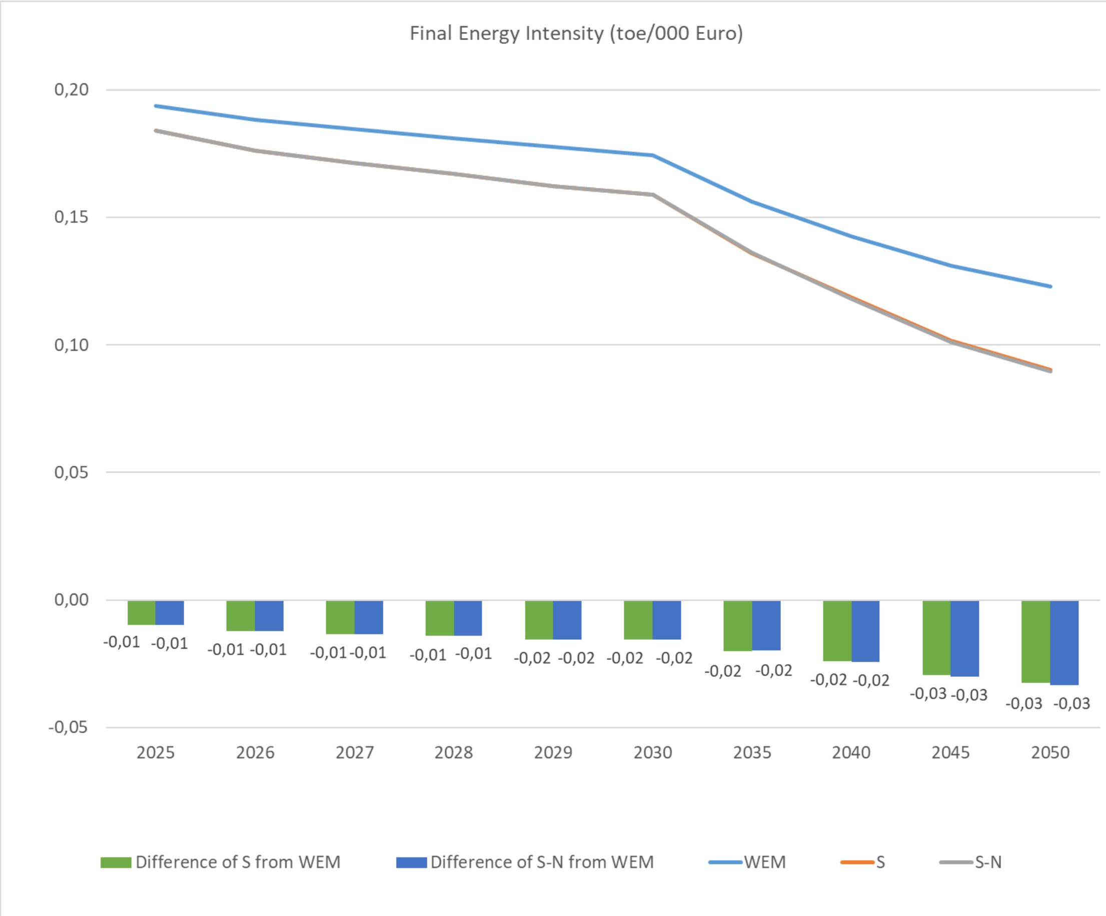


Figure 5.18: Final energy intensity during 2025-2050

In WEM scenario, gross inland consumption is equal to 18.5 Mtoe in 2030, higher than 15.5 Mtoe, which corresponds to scenarios S and S-N over the same year (Figure 5.19). Similarly, gross inland consumption is equal to 20.6 Mtoe in 2050 in WEM scenario, compared to 12.7 Mtoe in scenario S and 11.8 Mtoe in scenario S-N. Solid fuels as well as renewables and wastes comprise the fuels with the highest contribution in both 2030 and 2050.

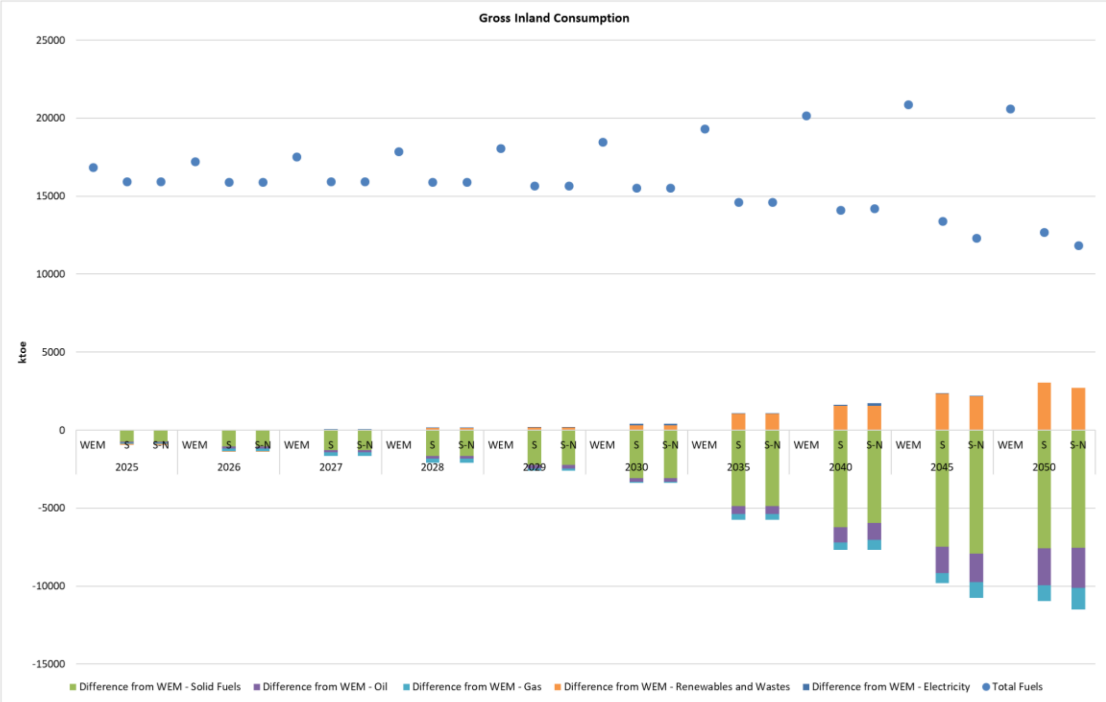


Figure 5.19: Gross inland consumption by fuel during 2025-2050

The final energy consumption of the industrial sector stands at 2,547 ktoe in 2030 in scenarios S and S-N leading to 9% lower consumption compared to WEM scenario due to the promotion of energy efficient equipment, the further development of energy management systems and the exploitation of the waste heat. The respective reduction will be increased to 11% in 2050 compared to WEM scenario as the final energy consumption will be equal to about 3.4 Mtoe due to the intensification of the energy efficiency measures counterbalancing the increased industrial output due to the GDP’s growth (Figure 5.20). Electricity, natural gas and oil products are the fuels with the highest contribution in scenarios S and S-N for both 2030 and 2050.

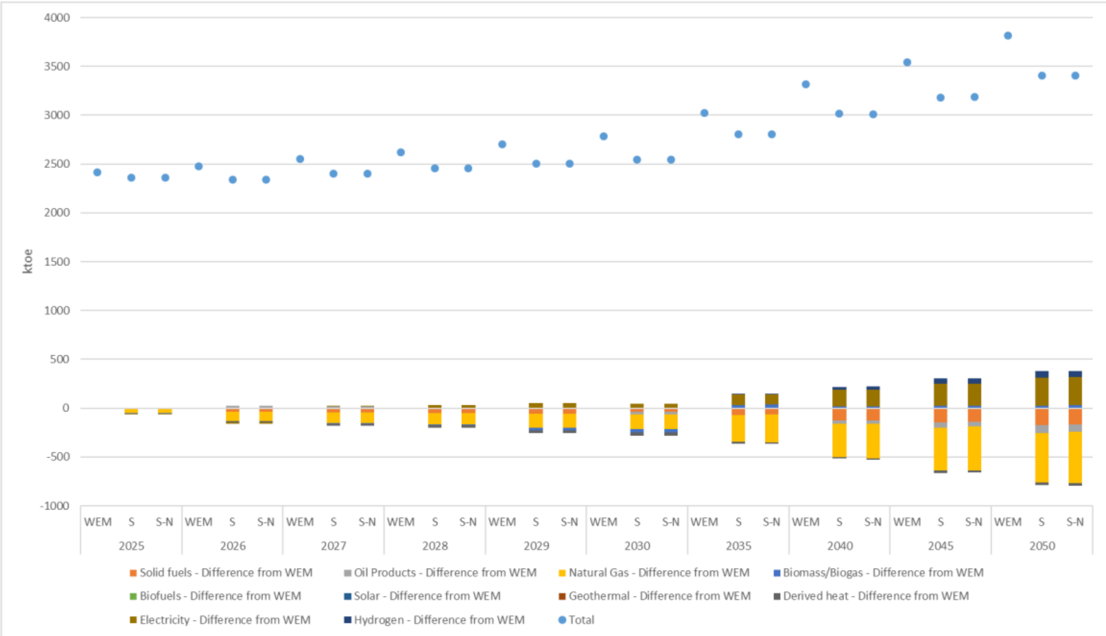


Figure 5.20: Final energy consumption per fuel in the industrial sector during 2025-2050

The final energy consumption of the transport sector in 2030 stands at 2,748 ktoe in WEM scenario, which is 9% higher compared to scenarios S and S-N (2,512 ktoe) due to the promotion of electromobility and the further penetration of hybrid diesel and gasoline vehicles in scenarios S and S-N. The final energy consumption is reduced by approximately 40% in 2050 for the case of scenarios S and S-N (about 2.2 Mtoe) compared to WEM scenario (3.7 Mtoe) due to the further deployment of electromobility and the promotion of hydrogen (Figure 5.21). Oil products is the most prevailing fuel in scenarios S and S-N for both 2030 and 2050.

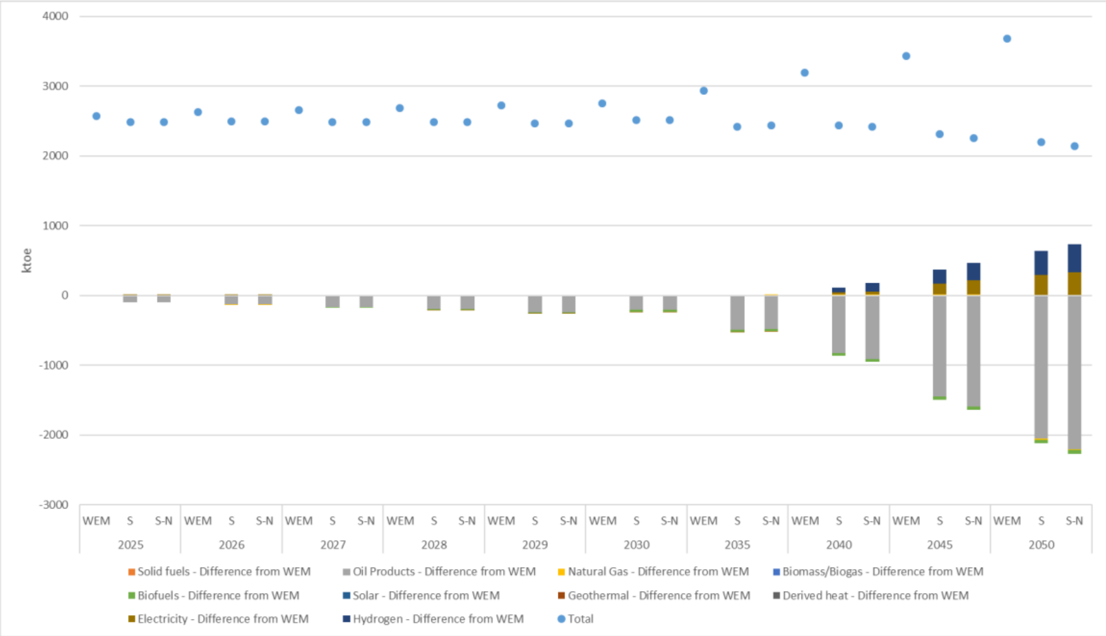


Figure 5.21: Final energy consumption per fuel in the transport sector during 2025-2050

The final energy consumption of the tertiary sector is equal to 1,097 ktoe in WEM scenario, while a meaningful reduction up to 17% is observed in scenarios S and S-N reaching 910 ktoe in absolute levels due to the increased energy renovation of the buildings, the installation of aerothermal and geothermal heat pumps and the promotion of energy efficient appliances and lighting. The intensification of the energy efficiency measures leads to a 24% reduction in 2050, as the final energy consumption reaches 1,579 ktoe in WEM scenario and about 1,200 ktoe in scenarios S and S-N (Figure 5.22). Electricity and natural gas comprise the fuels with the highest contribution in both 2030 and 2050 retaining also almost identical shares in scenarios S and S-N.

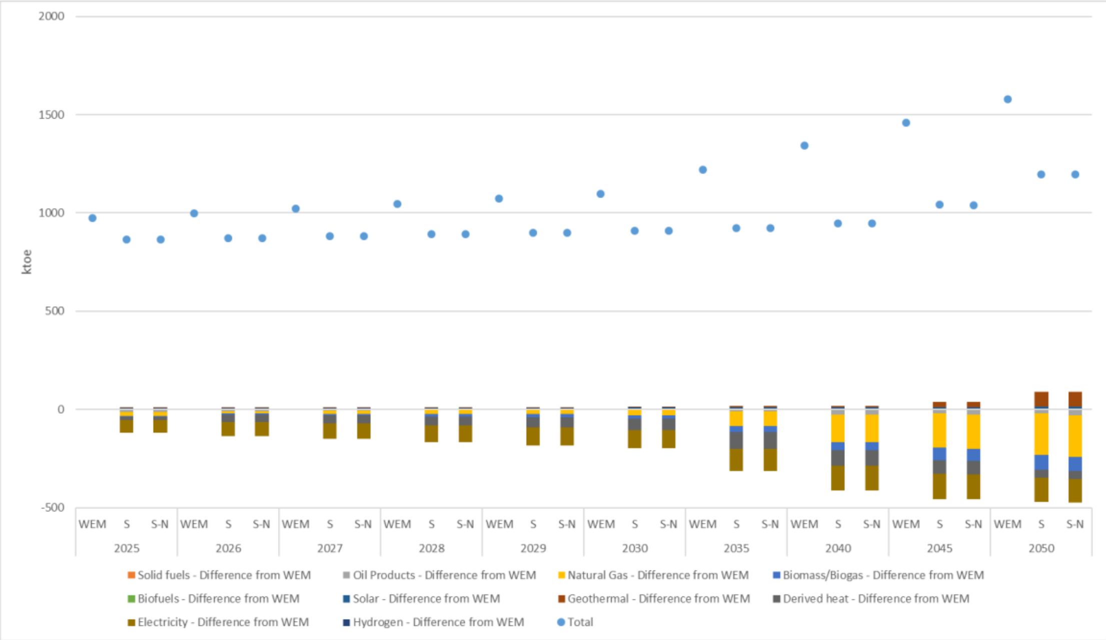


Figure 5.22: Final energy consumption by fuel in the services sector during 2025-2050

In residential sector, the final energy consumption amounts to 3,798 ktoe in WEM scenario and about 3,523 ktoe in scenarios S and S-N in 2030 mainly due to the increased energy renovation of the buildings, the installation of aerothermal heat pumps and the promotion of energy efficient appliances and lighting. The reduction of the final energy consumption is higher in 2050 for the case of scenarios S and S-N reaching 2.5 Mtoe compared to 3.7 Mtoe in WEM scenario due to the enhanced implementation of energy efficiency measures (Figure 5.23). Biomass/biogas, electricity and derived heat present the highest contribution in both 2030 and 2050.

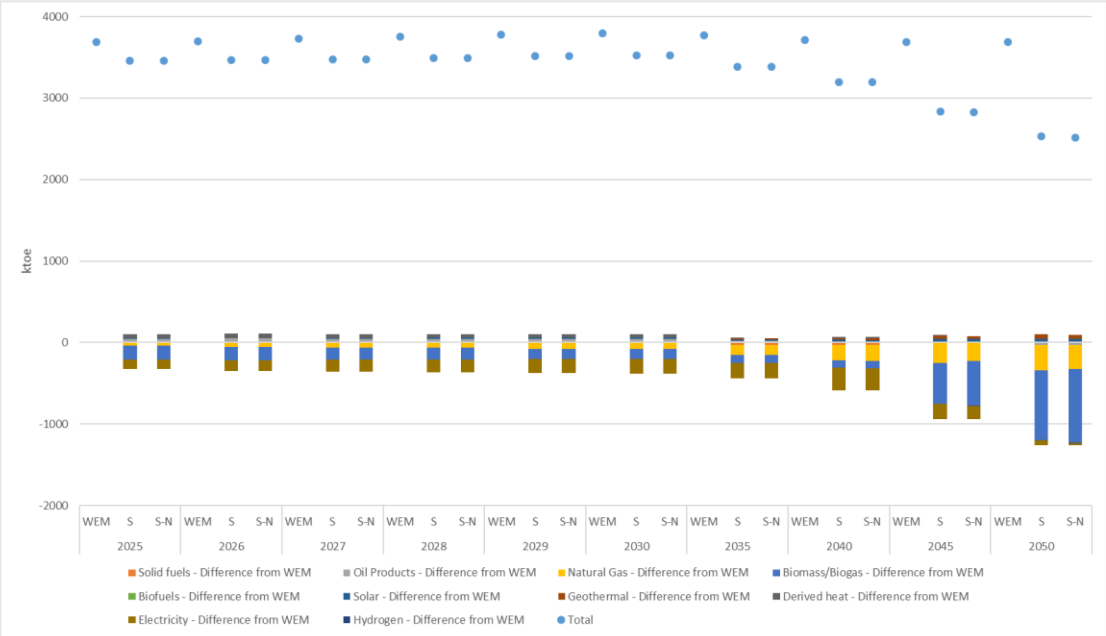


Figure 5.23: Final energy consumption per fuel in the residential sector during 2025-2050

In agriculture sector, the final energy consumption amounts to 159 ktoe in WEM scenario and 150 ktoe in scenarios S and S-N in 2030 due to the promotion of energy efficient machinery and the installation of energy efficiency equipment in greenhouses and pumping stations. The final energy consumption is increased slightly in 2050, as it will reach 169 ktoe in WEM scenario and 159 ktoe in scenarios S and S-N (Figure 5.24). Oil products and electricity consist of the fuels with the highest contribution in both 2030 and 2050 in scenarios S and S-N retaining identical shares.

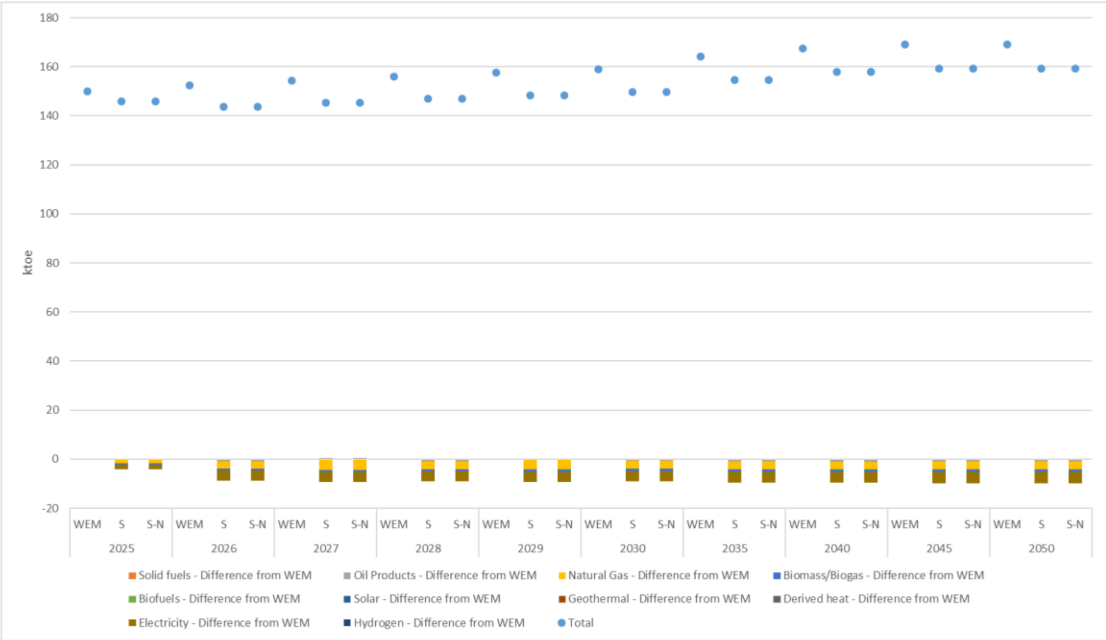


Figure 5.24: Final energy consumption per fuel in the agriculture/forestry sector during 2025-2050

The following issues were considered:

1 - sufficient improvement of energy efficiency through the introduction of efficient use measures

2 - insufficient improvement of energy efficiency due to the introduction of efficient use measures

3 - maintaining or reducing energy efficiency at existing levels

4 - reduction of final energy consumption linked to the introduction of efficient use measures

5 - maintenance of final energy consumption at the current level by introducing efficient use measures

Based on the above and as indicated in the table below, it can be concluded that the INECP will have an overall positive impact on the environmental specific objective " Increased energy efficiency and reduction of final consumption" (Overall rating ++ Strongly positive impact).

Table 5.3: Identification of the characteristics of the significant impacts of the implementation of INECP on the environmental specific objective " Increased energy efficiency and reduction of final consumption".

Environmental Objective	EO 01. Mitigation & resilience to climate change	Impact characterization						
		Type	Impact risk (Probability)	Intensity	Magnitude	Reversibility	Duration	Cumulativeness / Synergy
Specific Objective	SEO 01.2 " Increased energy efficiency and reduction of final consumption"							
Impact assessment question	EQ1.2. Will the INECP interventions support energy efficiency and a decrease of final consumption?							
Dimensions	GHG emissions and reduction	+	3	2	N/M	NR	2	1
	RES	++	3	2	N/M	NR	2	1
	Energy efficiency	++	3	2	N/M	NR	2	1
	Energy security	0	-	-	-	-	-	-
	Internal energy market	+	3	2	N/M	NR	2	1
	Research, innovation and competitiveness	+	2	1	N/M	NR	2	1
Overall assessment	++ strongly positive							

5.1.2.1.3 Environmental specific objective " Reduction of energy consumption in transport "

Evaluation of the impact of INECP implementation

Transport is a sector that has a very large influence on the use of energy, and therefore on the achievement of the objectives of the energy and environmental policy in Serbia.

In traffic, by 2030, a proportion of biofuel mixture of 2.5% will be introduced, with no more than 2 % of first-generation biofuels and no more than 1.7 % of biofuels produced from used cooking oil. By 2030, 15 % of new sales of passenger cars will be electric. The total share of electric vehicles reaches at least 15 % by 2040, while this share in 2050 is 50 %, and full electrification of railways will be reached by 2050, while 20 % of fuel for water transport in 2040 and 60 % in 2050 to be from electricity, hydrogen, bio-TPG.

The growth of passenger traffic is mostly influenced by a relatively high degree of mobility, and especially a very high level of motorization. The highways will have a greater increase in traffic because they carry more intercity traffic, which is growing faster than local, and because traffic is moving from less powerful parallel roads to more efficient and more comfortable roads. The structure of passenger transport will not change significantly until 2030. By far the largest share of transportation will be passenger cars.

INECP did not consider ensuring the conditions for sustainable mobility, which includes both walking and cycling. In this regard, it is necessary to promote the development of settlements and the priority integration of all forms of public transport in the "train-bus" transportation system, which is connected to parking lots and bicycle paths, to enable a "park and ride system". In addition to the improvement of integrated public transport, the development of non-motorized transport, such as cycling and walking, should be encouraged, especially in inner city and local areas.

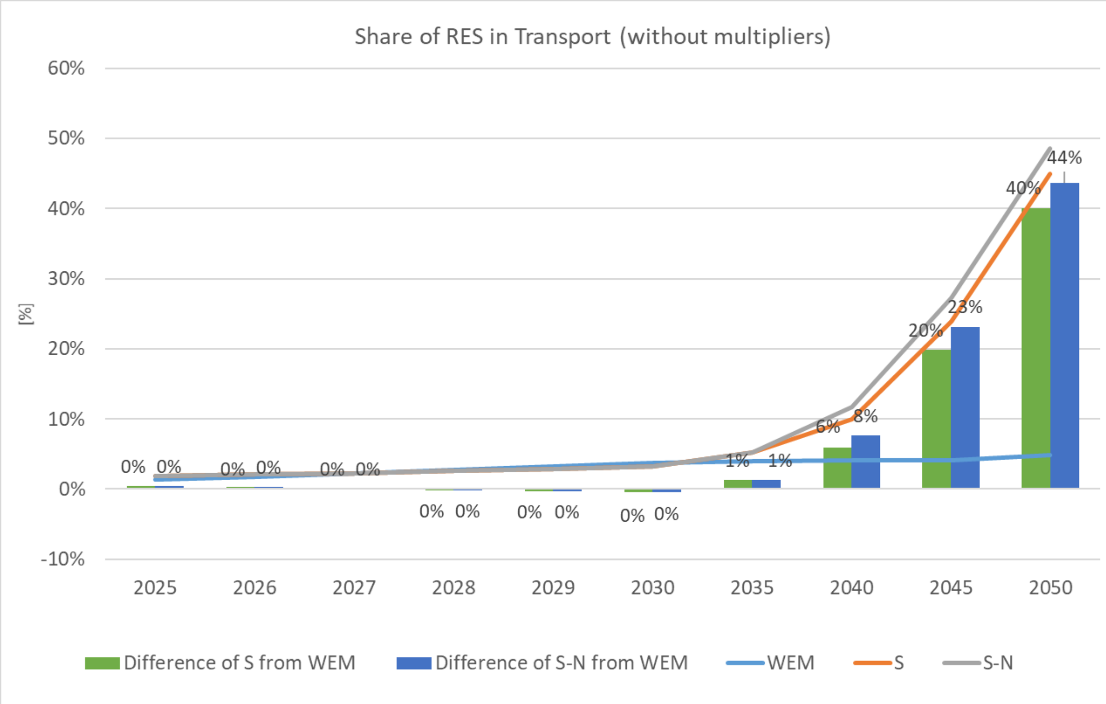


Figure 5.25: Share of RES in transport without multipliers

All scenarios lead to an increase in final energy consumption in the transport sector in 2030 compared to 2019. Scenario S and S-N lead to the smallest increase, while in WEM the demand increases at a higher rate.

Final energy consumption in the transport sector

FEC transport (ktoe)	2020	2025	2030
WEM	2347	2573	2748
Scenario S	2347	2481	2512
Scenario S-N	2347	2481	2512

Energy efficiency measures targeting transport are proposed in the INECP which are expected to positively contribute to the reduction of final energy consumption in transport.

The following issues were considered:

1 - increase in road and rail passenger and freight traffic with reduced energy consumption

2 - improvement of cycling infrastructure

3 – improvement of energy efficiency in transport

Based on the above and as indicated in the table below, it can be concluded that the INECP proposed scenario will have an mixed impacts on the environmental specific objective "Reduction of energy consumption in transport"; when mitigation measures are implemented, negative impacts are expected to be reduced (Overall rating +/- Mixed)

Table 5.4: Identification of the characteristics of significant impacts of the implementation of INECP on the environmental specific objective " Reduction of energy consumption in transport

Environmental Objective	EO 01. Mitigation & resilience to climate change	Impact characterization						
		Type	Impact risk (Probability)	Intensity	Magnitude	Reversibility	Duration	Cumulative ness / Synergy
Specific Objective	**SEO 01.3 " Reduction of energy consumption in transport"**							
Impact assessment question	EQ1.3. Will the INECP interventions lead to a decrease of energy consumption in the transport sector?							
Dimensions	GHG emissions and reduction	+	1	1	N/M	NR	2	1
	RES	-	2	2	N/M	NR	2	1
	Energy efficiency	+	2	2	N/M	NR	2	1
	Energy security	0	-	-	-	-	-	-
	Internal energy market	?	-	-	-	-	-	-
	Research, innovation and competitiveness	+	2	1	2	NR	2	1
Overall assessment	+/- mixed							

5.1.2.1.4 Environmental specific objective "Promotion of Circular economy "

Evaluation of the impact of INECP implementation

The transition to a more circular economy is a key factor as in reducing GHG emissions. The shift to a circular pattern can lead to a significant reduction in GHG emissions through the recycling and re-use of materials, the more efficient use of resources and more eco-friendly product design, as well as the introduction of new circular business models, especially in industry, transport and the built environment. The WAM scenario is expected to promote actions in accordance with the Roadmap for Circular Economy in Serbia aiming at shifting to a circular pattern.

In the area of waste, INECP predicts a 31% reduction in GHG emissions compared to 2015. It is expected that this will be achieved through a series of existing and proposed measures, which will have a positive impact on the transition to circular economy. Improved management of waste, increased recycling, the production and use of biofuels, the development o effective supply chains of residual biomass, etc. are some of measures expected to have a positive impact with regards to circularity.

In industry, INECP predicts an increase in production with a decrease in specific energy consumption per product unit. Scenario WAM foresees additional measures to accelerate development in the areas of energy efficiency, replacement of energy sources with renewable sources and technological innovation. Actions are planned to be implemented through the promotion of circular economy including the exploitation of waste heat and the extended digitalization of the industrial processes.

Measures for the promotion of research and innovation are also expected to reinforce the transition to a climate-neutral and circular economy and to contribute to the promotion of concrete actions focusing on the development of innovative technologies to achieve the objectives of the National Roadmap for Circular Economy. .

The following issues were considered:

1 - impact of waste management practices including impact of reuse and recycling of waste

2 - impact on the introduction of the circular economy practices in industry

3 – impact of innovative technologies developed through Research and Innovation

Based on the above and as indicated in the table below, it can be concluded that the INECP proposed scenario will have a positive impact on the environmental specific objective "Promotion of circular economy" (overall rating + positive).

Table 5.5: Identification of the characteristics of significant impacts of the implementation of INECP on the environmental specific objective "Promotion of circular economy".

Environmental Objective	EO 01. Mitigation & resilience to climate change	Impact characterization						
		Type	Impact risk (Probability)	Intensity	Magnitude	Reversibility	Duration	Cumulative ness / Synergy
Specific Objective	**SEO 01.4 " Promotion of circular economy"**							
Impact assessment question	EQ1.4. Will the INECP contribute to the promotion of circular economy, thereby mitigating and increasing resilience to climate change?							
Dimensions	**GHG emissions and reduction**	+	2	1	N/M	NR	2	1
	RES	+	2	2	N/M	NR	2	1
	Energy efficiency	+	2	1	N/M	NR	2	1
	Energy security	0	-	-	-	-	-	-
	Internal energy market	0	-	-	-	-	-	-
	Research, innovation and competitiveness	+	2	1	2	NR	2	1
Overall assessment	+ positive							

5.1.2.2 Environmental Objective "Protection of human health"

5.1.2.2.1 Environmental specific objective " Reduction of air emission, including GHG emissions, by 40.3% in 2030 compared to 1990"

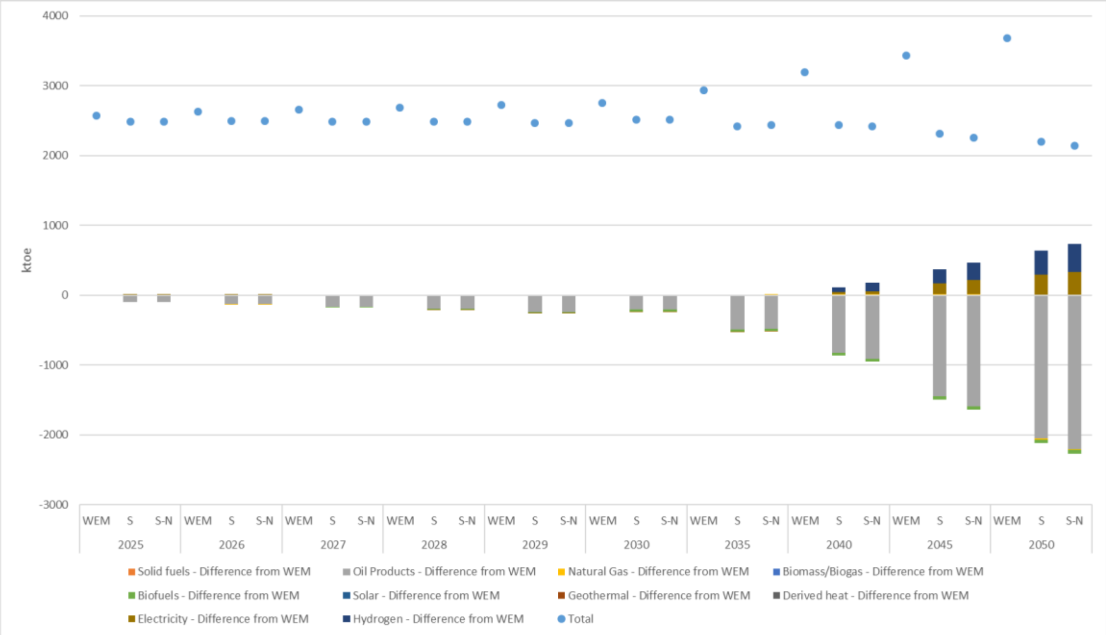
Evaluation of the impact of INECP implementation

i. Impact of air emissions due to increased freight and passenger traffic and changes in fuel structure

Transport is one of the main sources of emissions of nitrogen oxides and dust particles of various sizes, which cause acidification and ozone formation. Due to heavy traffic, cities and city centres and areas along main roads are especially exposed to poor ambient air quality, especially in the morning and afternoon hours. Renewal of the vehicle fleet contributes significantly to the reduction of the emission of polluting substances, as it ensures that the target reductions in the emission of polluting substances from transport are largely achieved. Measures to promote public passenger and rail freight transport also helps to reduce pollutant emissions. The construction of bypasses and new connecting roads with the city centres also has a positive impact, especially in cases of congestion. It is worth noting attention should be paid to the accessibility of public transport in order to further reduce the environmental burden of emissions and dust particles in urban centres.

Due to its position at the crossroads of two European corridors, Serbia has a distinct transit position. The international truck traffic has a significant impact on the final energy balance of Serbia. Transport is a sector that has a very large impact on the use of energy and, consequently, the emission of pollutants into the air, and therefore on the implementation of energy and environmental policy at the national level. The final energy consumption of the transport sector in 2030 stands at 2,748 ktoe in WEM scenario, which is 9% higher compared to scenarios S and S-N (2,512 ktoe) due to the promotion of electromobility and the further penetration of hybrid diesel and gasoline vehicles in scenarios S and S-N. The final energy consumption is reduced by approximately 40% in 2050 for the case of scenarios S and S-N (about 2.2 Mtoe) compared to WEM scenario (3.7 Mtoe) due to the further deployment of electromobility and the promotion of hydrogen (Figure 5.26). Oil products is the most prevailing fuel in scenarios S and S-N for both 2030 and 2050.

Figure 5.26: FEC fuel transport

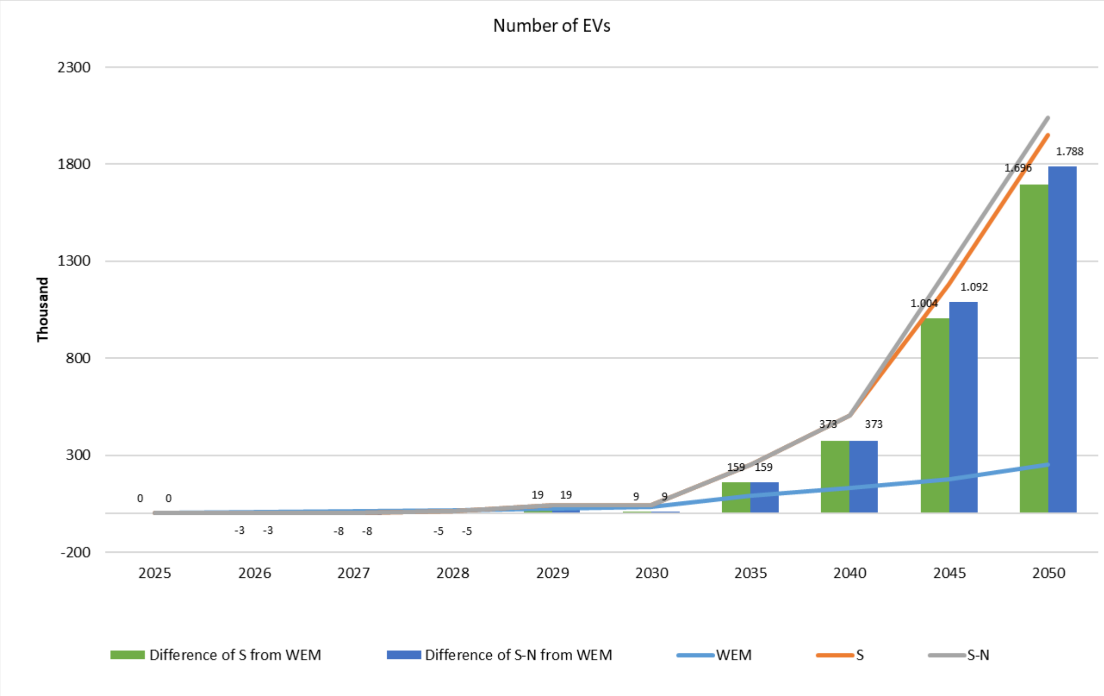


Passenger traffic

Projections of passenger traffic until 2030 show an increase. It is estimated that the structure of passenger traffic will not change significantly until 2030, because the largest part of the transport will be passenger cars. The analysis of passenger traffic includes the following means of transport, namely motor mopeds, passenger trains, buses and domestic and foreign passenger vehicles.

The cumulative number of electric vehicles is equal to 45 thousand, 507 thousand and about 2,000 thousand in 2030, 2040 and 2050 respectively in both scenarios S and S-N indicating the impact of the targeted policies and measures for the promotion of electromobility (Figure 5.27). A huge deployment in EVs is anticipated from 2030 to 2050 in both scenarios S and S-N, compared to an insignificant one in WEM scenario.

Figure 5.27: EV number



Cargo

Projections for freight traffic, which includes trucks and trains, are growing even faster than passenger traffic. Different growth rates are also influenced by the introduction of the circular economy, which is reflected in a lower need for the production of new products, and therefore in a lower need for freight transport. In addition, the lower growth rates are significantly influenced by the digitization of industry and logistics, which enables significant optimization of production processes and transportation. Until 2040, the growth of freight traffic will continue, but with a significantly lower average annual growth rate.

Electrification of the fleet is also planned in the segment of light trucks, but at a slower pace than in the case of passenger cars.

In the case of heavy goods vehicles and buses, electrification of battery vehicles makes less sense due to technological limitations, especially for vehicles traveling long distances. Battery vehicles in the form of fully electric vehicles (plug-in) and hybrids were largely intended for heavy goods vehicles and public passenger buses, while there is a shift to gas-powered vehicles for tow trucks and buses. The share of hydrogen vehicles is small due to the current uncertainty about the further development of the technology (despite recent information that the development of fuel cells has gained momentum) as well as due to large investments in charging infrastructure.

It is expected that the implementation of measures to achieve objectives in the area of air emissions reduction in the transport sector will have positive effects due to the reduction in diesel and gasoline consumption and the increase in the consumption of electric vehicles in passenger and freight traffic.

In this case, the use of energy in passenger and freight transport is used as an indirect indicator of the impact of transport on emissions of pollutants into the air.

ii. Impact of emissions of substances in the air due to changes in the operation of coal, natural gas and biomass in thermal power plants

Large combustion plants use different sources of energy (coal, heating oil, natural gas) for their operation. During combustion, waste gases are created, which are released into the air through the flue gas outlet. In terms of ambient air pollution, coal is the biggest source of various pollutants.

Harmful impacts of coal exploitation are not unique to all coal mines. They differ from each other depending on the method of exploitation (pit or surface). Surface mining of coal has significantly more harmful effects on the environment compared to mines with underground mining. With surface exploitation, significant negative impacts on the environment are manifested through impacts on geological structure, hydrogeology and groundwater quality, surface hydrology and surface water quality, hydrographic network, soil (in terms of quantity and quality, as well as changes in its use), air quality, generated noise levels, waste production and management (industrial and municipal), infrastructure facilities (primarily traffic), existing flora and fauna and eco-systems, landscape features, cultural heritage, demography and population distribution, social aspects, human health, occurrence of erosion processes and flood hazards, as well as long-term risks and their sources.

The impacts of coal use on the environment range from the pollution of local waterways to the global problem of climate change by carbon dioxide emissions from coal combustion. "Clean coal" technologies are expensive and still not able to completely eliminate harmful emissions from thermal power plants that use coal as fuel.

In Figure 5.28 the possible impacts of coal exploitation and electricity production on air, water and soil are presented.

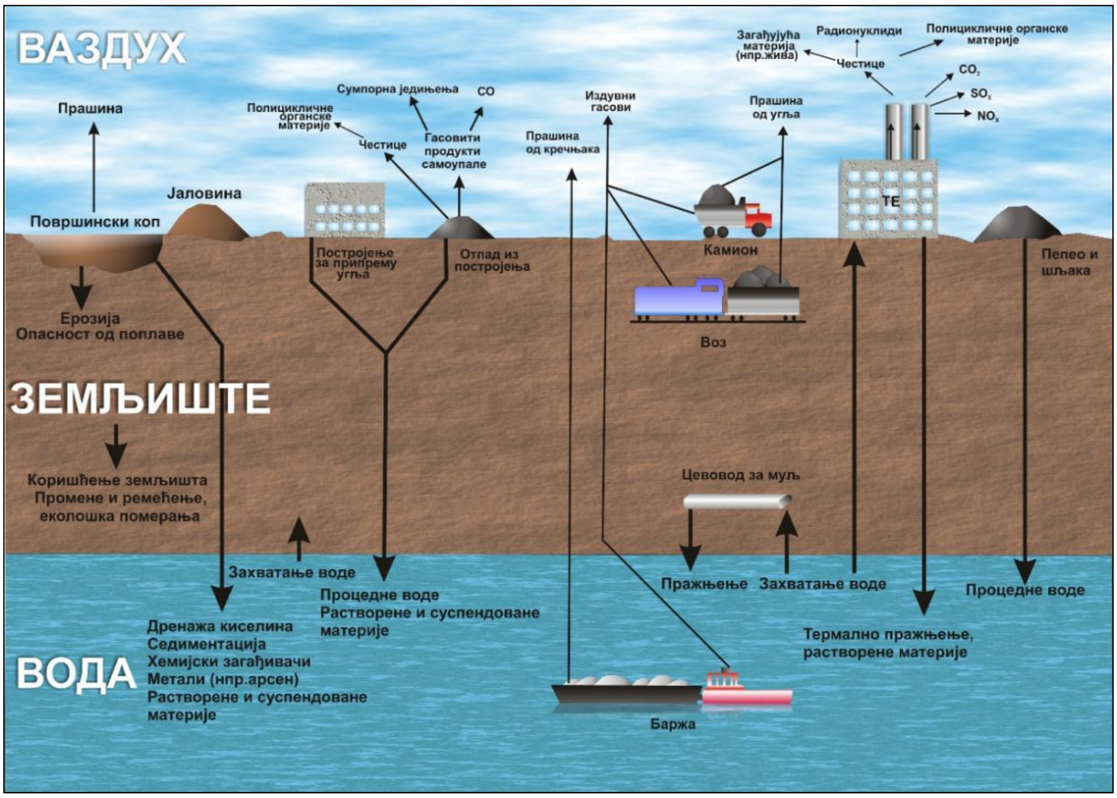


Figure 5.28: Possible impacts on air, water and soil due to the exploitation of coal

From the environmental point of view, natural gas is a cleaner energy source than coal, but it still emits certain pollutants, although in much smaller quantities. Therefore, reducing the consumption of coal and switching to natural gas is one of the measures that positively affects the environment and human health and will gradually contribute to the reduction of ambient air pollution.

The key objective of the "Energy security and internal energy market" dimension aims, among other things, to minimize the use of fossil fuels and dependence on fossil energy imports, by gradually abolishing the use of coal by 2050 and banning the sale and installation of new fuel oil boilers.

The decrease in coal consumption will mainly be reflected in the consumption of lignite due to the gradual closure and stop of operation of certain thermal blocks. **WAM has a positive impact, as it contributes to the further reduction of emissions of SO2, NOX and a number of other pollutants in the ambient air.** Certain thermal power plants will continue to contribute significantly to national emissions in the period up to 2050, since their operation is also planned after 2030.

The planned reduction in coal consumption at the locations of TPP Morava and TPP Kolubara will be replaced to some extent by the installation of new thermal power plants on natural gas. Therefore, they will have to be subject to an environmental impact assessment in accordance with the Law and Regulation. In addition, large combustion plants are included among the facilities that can cause more environmental pollution, so it will be necessary to obtain an integrated permit (IPPC). All such plants must ensure that their operating conditions are in accordance with IPPC permit. It is estimated that reducing coal consumption and switching to other, cleaner energy sources will have a positive impact on meeting national emission ceilings.

iii. Impact of emissions of substances in the air due to a change in the type of energy used for household heating

In the emission balances, the sector of fuel consumption in households and the service sector represents a significant share of $PM_{2.5}$ and NMVOC emissions, the source of which is mainly small plants that burn biomass or wood.

In the area of reducing energy use and GHG emissions in households, INECP analysed several measures to improve energy efficiency and use of renewable energy, which have a positive impact on the national emission balance, namely: renovation of old apartments and construction of new buildings in accordance with new standards.

Reducing energy consumption, switching to renewable energy sources (geothermal and solar energy) and replacing energy sources with a smaller carbon footprint will also reduce emissions of pollutants in the air, which greatly contribute to reduction of local air pollution and cumulatively with other sectors reduce the national balance of substance emissions in the air.

During the operation of the plant for the production of thermal energy, there are significant emissions of pollutants due to the use of wood biomass as fuel. As a rule, the new use of woody biomass in combustion plants is considered an acceptable pressure on the achievement of environmental targets for pollutant emissions if it is carried out in conjunction with the introduction of new techniques of woody biomass in combustion plants or connecting existing buildings with individual heating plants or introducing highly efficient cogeneration. The intended use of wood biomass as a renewable energy source has a negative impact on efforts to reduce emissions of pollutants, but the consequences of this impact are reduced to an acceptable level for the environment through other INECP measures and energy efficiency measures. These negative impacts of the use of wood biomass, especially in urban areas, must be consistently compensated by other measures (especially energy efficiency measures) to the extent that the entire area ensures the reduction of outdoor air pollution by particles.

Despite the fact that wood biomass has higher emission factors than other fuels, its use for energy purposes makes sense due to its affordability and self-sufficiency at the individual and national level. In addition, it is a free source of heating for socially vulnerable households, which alleviates the pressure on increasing energy poverty.

iv. The impact of the construction of infrastructure facilities on the dispersion of dust particle emissions

INECP foresees the construction or reconstruction of a large number of infrastructure facilities, for which it will be necessary to carry out a comprehensive environmental impact assessment and obtain a building permit. At this point it is noted that some larger projects are proposed where the construction works take longer and require a larger number of construction machines and the excavation of a larger amount of land. Therefore, construction machines and excavations represent diffuse sources of emission of polluting substances that can cause excessive environmental pollution, which will require greater attention: During construction, the rules of conduct when performing construction work on the construction site, requirements for construction machinery and organizational measures in order to preventing and reducing the emission of particles that occur during the intervention must be observed. The mitigation measures will be included in the EIA which will be performed according to national legislation.

It is estimated that during the construction or reconstruction of infrastructure facilities, emissions of pollutants are short-lived, and the effects of these emissions are **at local or regional level.**

Emissions of sulphur dioxide

Sectoral distribution of SO2 emissions shows that the biggest source of emissions is energy supply or more precisely, the production of electricity and thermal energy.

Emissions of nitrogen oxides

As already mentioned, transport is the main source of NOX emissions, and the next sector is Energy Supply. The reduction of NOx emissions is expected due to the reduction of electricity and thermal energy production from coal, the replacement of coal with natural gas and the increase of electricity production from RES.

Significant reductions in emissions will also be achieved in the sector involving energy use in buildings (households and services) and agriculture. The reduction is largely due to the reduction of the emission factor for tractors, which, like road vehicles, are subject to Euro standards.

Emissions of particles smaller than 2.5 micrometres

Emissions of PM2.5 particles have proven to be the most problematic pollutant in terms of reduction. By far the biggest source of emissions is the burning of wood biomass in households. The use of wood biomass is highly dependent on the price of fossil fuels. In addition, utilization is affected by the availability of woody biomass due to forest damage and the attractiveness of other alternatives. In recent years, heat pumps have proven to be a suitable alternative to the use of wood biomass, where there is no ban or restriction, but wood biomass will remain an important energy source. Emission projections predict faster replacement of old biomass burning plants. In order to achieve a reduction, it will be necessary to intensify the replacement of old wood biomass boilers, ban the sale of inefficient wood biomass boilers, and raise awareness and train users how to use the devices properly. Reducing emissions from this source is key to achieving the 2030 emissions target.

The fuel burning sectors in industry and transport also stand out for their share of total emissions. In industry, emissions are largely due to the burning of wood biomass. As its use increases, so does the constant emission factor. Traffic is the main source of emissions for diesel vehicles. With the introduction of stricter Euro standards, emission factors are drastically reduced, so it is expected that emissions from transport will decrease in the period up to 2030. In the remaining sectors, there are no significant changes in emissions, or their contribution to total emissions is small.

Ammonia NH3 emissions

By far the largest source of NH3 emissions is agriculture. The second largest source of NH3 emissions is the widespread burning of wood. Reducing the use of wood biomass due to energy efficiency measures and replacing old boilers with new ones contributes to the reduction of emissions from this source.

GHG emissions

A goal of INECP was set to reduce GHG emissions by 40.3% in 2030 compared to 1990. A well-balanced mix of policies and measures will be launched to reduce GHG emissions in all supply and demand sectors.

Priority is also given to adaptation to climate change because the Republic of Serbia will develop and adopt the National Strategy for Adaptation to Climate Change, which will specify the general goals, guidelines and means for implementing a modern, effective and development strategy for adaptation to climate change within the framework set by the United Nations. Nations Convention on Climate Change, EU directives and international experience.

Finally, the promotion of the circular economy and bioeconomy will be promoted, which will also contribute to the objective achievement of climate change mitigation. The transition to a circular economy can lead to a significant reduction of GHG emissions through recycling and reuse of materials, more efficient use of resources and more environmentally friendly product design, as well as the introduction of new circular business models, especially in industry, and transport.

<u>Trends in current GHG emissions and removals in the ETS, Effort Sharing Regulation and LULUCF sectors and different energy sectors.</u>

The evolution of total GHG emissions, with and without LULUCF, follows a similar trend in the period 2010-2019. Although there have been several fluctuations over the decade, total GHG emissions were 56.6 Mt CO2eq (including LULUCF) and 61.5 Mt CO2eq (excluding LULUCF) in 2019, similar to the 2010 level of 52, 2 Mt CO2eq (including LULUCF) in 2019 LULUCF) and to 63.3 Mt CO2eq (excluding LULUCF), respectively, as shown in **Error! Reference source not found.**, despite a significant increase in GDP. Obviously, the continued use of natural gas and the promotion of energy efficiency and RES technologies in all end-use sectors have managed to curb the increase in GHG emissions.

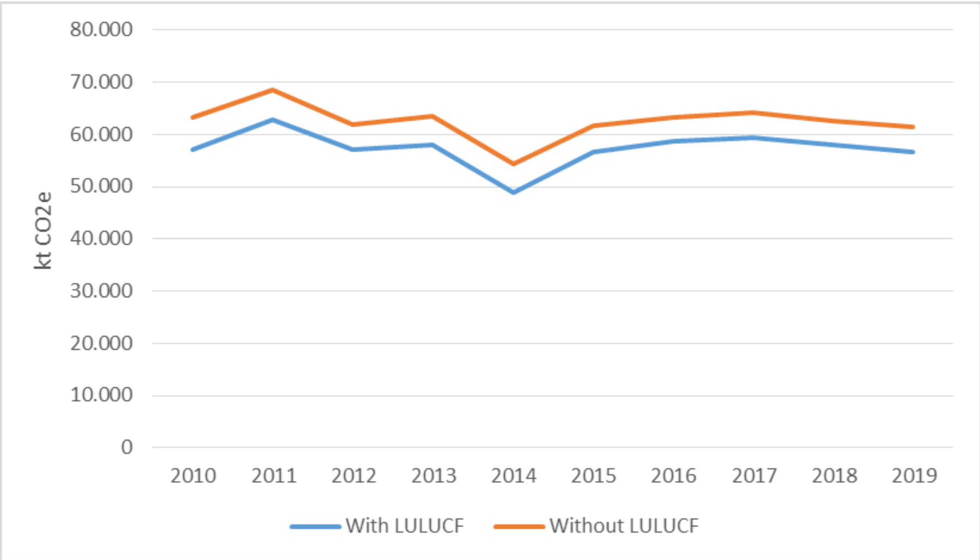


Figure 5.29: Total GHG emissions (with and without LULUCF) during 2010-2019

Projections of sectorial trends with existing national and EU policies and measures at least until 2040 (including 2030)

In WEM scenario, CO2 emissions are equal to 60.4 Mt in 2030, higher than 44.3 Mt in scenarios S and S-N over the same year (Figure 5.30). In 2050, total CO2 emissions will increase only in WEM scenario by 10.7% at 66.9 Mt, compared to 2030 level, while a 61.3% decrease (at 17.1 Mt) in scenario S and a 64.9% fall (at 15.6 Mt) in scenario S-N are anticipated. Electricity and CHP as well as industry are the sectors with the highest CO2 emissions in both 2030 and 2050 in all scenarios, followed by transport.

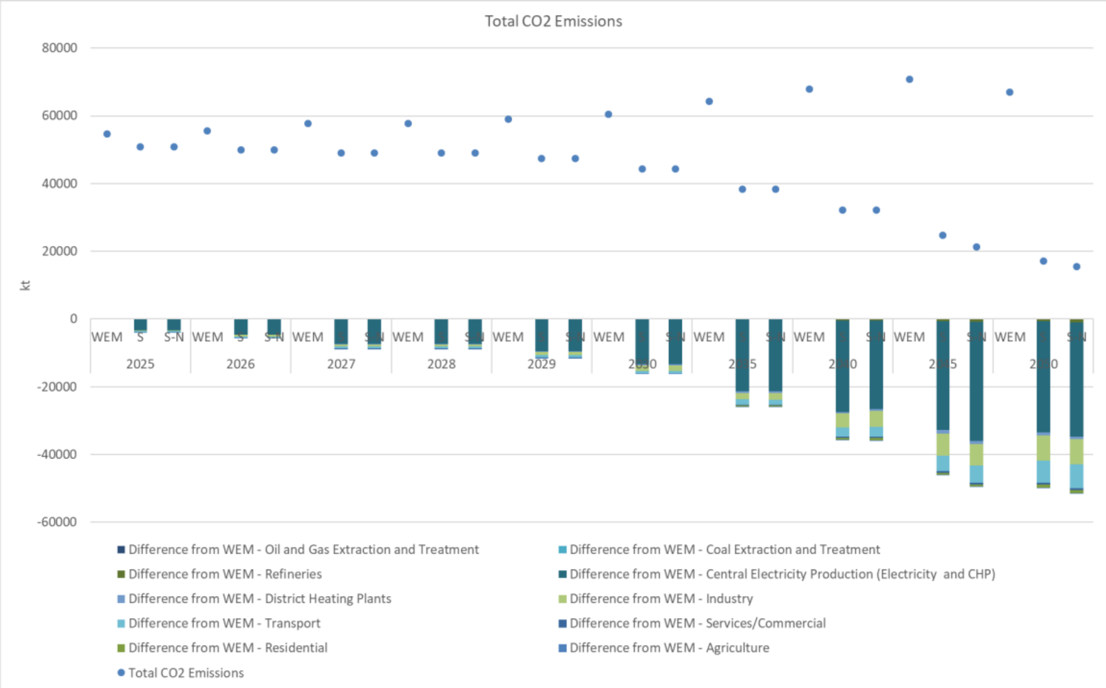


Figure 5.30: CO2 emissions by sector during 2025-2050

In WEM scenario, total CH4 emissions are equal to 116 Mt in 2030, higher than 93 Mt in scenarios S and S-N over the same year (Figure 5.31). In 2050, total CH4 emissions will decrease by 29.5%, 79.9% and 80.3% in scenarios WEM, S and S-N respectively, compared to 2030 level. Coal extraction and treatment as well as oil and gas extraction and treatment are the sectors with the highest CH4 emissions in both 2030 and 2050 in all scenarios, followed by residential sector.

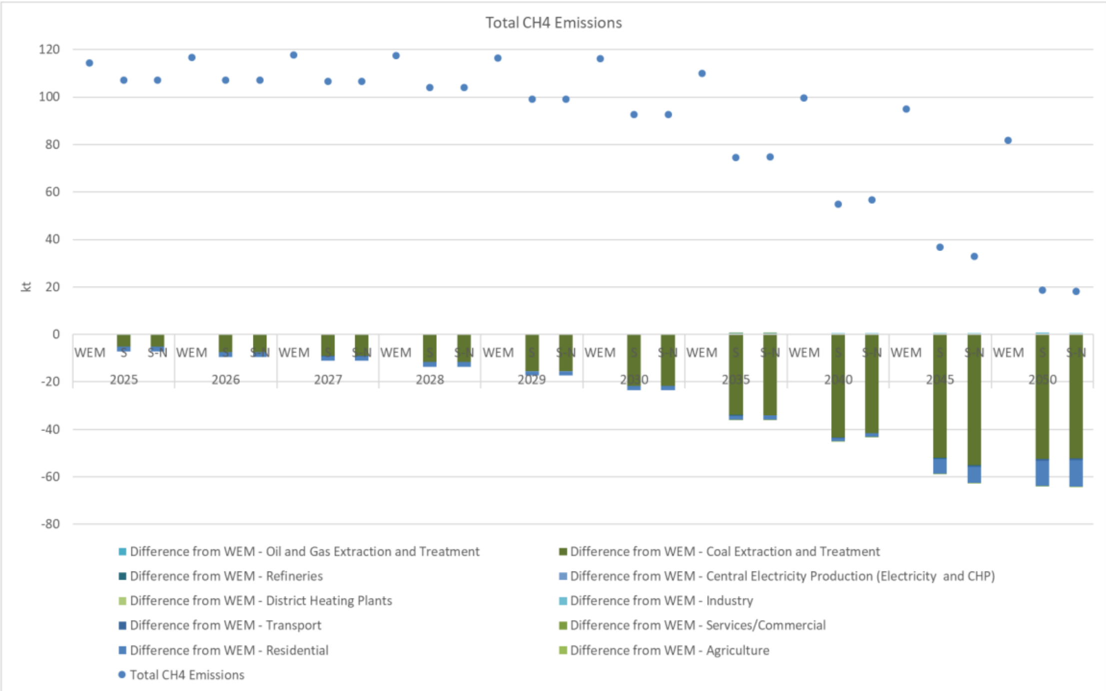


Figure 5.31: CH4 emissions by sector during 2025-2050

Similarly, total N2O emissions are equal to 3.2 kt in 2030 in WEM scenario, higher than 3.0 kt in scenarios S and S-N over the same year (Figure 5.32). In 2050, total N2O emissions will increase only in WEM scenario by 8.8% at 3.5 kt, compared to 2030 level, while a 10.2% decrease (at 2.7 kt) in scenario S and a 11.9% fall (at 2.6 kt) in scenario S-N are anticipated. Industry and transport are the sectors with the highest N2O emissions in both 2030 and 2050 in all scenarios, followed by electricity and CHP.

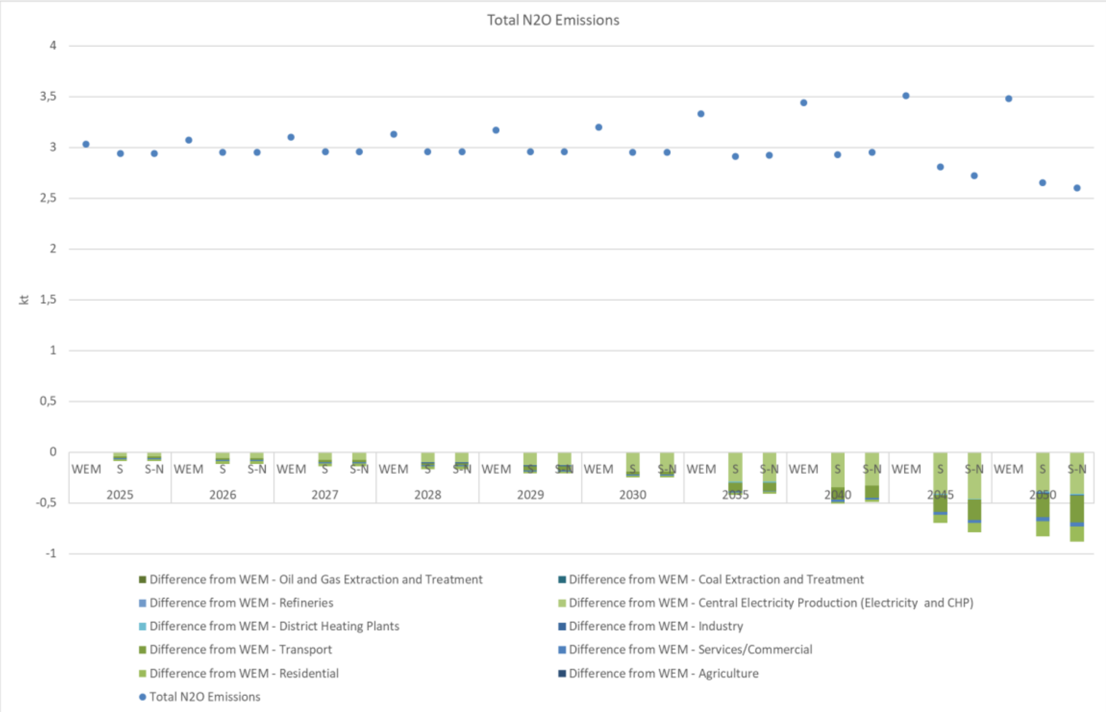


Figure 5.32: N2O emissions by sector during 2025-2050

The following issues were considered:

1. impact of emissions of substances in the air due to the increase in freight and passenger traffic and changes in the fuel structure
2. impact of emissions of substances in the air due to changes in the operation of coal, natural gas and biomass thermal power plants
3. impact of emissions of substances in the air due to a change in the type of energy used for household heating
4. the influence of the construction of infrastructure facilities on the dispersion of dust particle emissions

Based on the analysis, possible additional measures that will help in achieving the target national limits for emissions of ambient air pollutants are identified. While positive impacts are expected from PM of most Dimensions of the INECP, some negative, short-term, reversible impacts are expected, particularly due to the development or upgrade of a large number of infrastructure / facilities. These negative impacts can be prevented or reduced with the implementation of appropriate mitigation measures, particularly through the dedicated EIAs for each infrastructure project. The overall assessment is Mixed +/-.

Table 5.6: Identification of characteristics and significant impacts of INECP implementation on the environmental sub-objective " Reduction of air emission, including GHG emissions, by 40.3% in 2030 compared to 1990".

Environmental Objective	EO2. Protection and improvement of human health	Impact characterization						
		Type	Impact risk (Probability)	Intensity	Magnitude	Reversibility	Duration	Cumulativeness / Synergy
Specific Objective	**SEO 02.1 "Reduction of air emission, including GHG emissions, by 40.3% in 2030 compared to 1990"**							
Impact assessment question	EQ2.1. Will the interventions of INECP lead to a reduction of polluting air emissions?							
Dimensions	GHG emissions and reduction	++	2	2	N/M	NR	2	1
	RES	++	2	2	N/M	NR	2	1
	Energy efficiency	+/-	2	1/2	G-R	R/NR	1/2	1
	Energy security	-	2	2	G	R	1	1
	Internal energy market	-	2	1	R	R	1	1
	Research, innovation and competitiveness	+	2	1	N/M	NR	2	1
Overall assessment	+/- Mixed							

5.1.2.2.2 Environmental specific objective " Ensured supply of adequate and healthy drinking water to the population"

Evaluation of the impact of INECP implementation

Impacts on water during construction interventions on human health

Among the measures foreseen by INECP that can affect the quality and quantity of drinking water are hydropower plants, railway and road network, use of geothermal energy, wind farms.

Accumulations of HPP, RHPP and MHPP can have a permanent and long-term impact on drinking water, because they can affect the flow and level of groundwater. If there is a source of drinking water in the zone of influence, it is possible to influence the quality and quantity of water at the pumping station. In the event that HPPs reduce the volume of groundwater, there may be a cumulative and synergistic effect, i.e., an increase in the concentration of pesticides and nitrates. For example, along the left bank of the Sava River from Obedska Bara to Belgrade, there are ancient wells for the water supply of Belgrade, the largest urban agglomeration. (It is known that in periods of high-water level due to HPP Đerdap1 the water level of the Danube rises, but the impact is also felt on the Sava River upstream from Šabac and almost to Sremska Mitrovica), where are the potential impacts on the availability and quality of drinking water (Novi Sad for water supply uses Danube water, and Belgrade uses Sava water).

The implementation of INECP may also affect the use of drinking water during the exploitation of other planned interventions (wind farms, biogas plants, construction of transport infrastructure, expansion of industrial production), if they are planned in protective zones of water sources or near drinking water pumping stations.

The implementation of large RHPP and some other infrastructure projects/facilities planned in INECP are projects that require an environmental impact assessment in accordance with the Law on environmental impact assessment. Considering mitigation measures derived from spatial planning assessments, state and municipal drinking water protection ordinance restrictions, water permit restrictions, and land or water emissions restrictions, impacts on pump station water use are unlikely to have a significant impact. However, the impacts on the use of drinking water can be significant, if a large part of the pumping stations are not protected by appropriate protection regimes. The impact of INECP on the use of water is therefore assessed as insignificant only considering the mitigation measures related to the protection of drinking water sources. The assessment of the impact of individual locations is carried out at more detailed levels of planning, within the framework of environmental impact assessment and procedures for issuing permits.

Due to the installation of RHPP Bistrica, the implementation of INECP may have a local impact on the quality of drinking water, if they are implemented in the sanitary zones of water source protection or near the source for water supply. In the case of the planned construction of RHPP in the water protection area, an analysis of the risk of source pollution must be carried out before implementation and a relevant permit must be obtained.

With the planned promotion of biogas production, the formation of sludge (digestate) can be expected, which is used as a fertilizer and, if used inappropriately, can be a source of contamination of drinking water with nitrates.

Measures targeting improved management of waste, wastewater treatment and discharge, are expected to have positive impacts on the specific environmental objective.

The implementation of INECP will not lead to changes in the number of inhabitants supplied from the drinking water supply system, but it may have an impact on water quality. In cases, where it is shown in the next stages of planning, that the implementation of INECP will lead to interventions that could affect the quality of drinking water in areas where drinking water monitoring has not been established, monitoring should be established.

INECP does not predict new significant sources of microbiological pollution.

INECP foresees an increase in the area covered by solar power plants. Energy-efficient use of solar receivers also requires periodic cleaning of the receiver. The treatment process creates wastewater that can be contaminated with detergent residues and substances removed from the surface of the receiver during the treatment process, especially powdery particles that carry various pollutants. This type of wastewater must be discharged into a public sewer that ends with a municipal wastewater treatment plant. If this is not possible, before releasing it into the environment, the properties of this type of wastewater from panel cleaning must be checked, and based on the results of the analysis, the method of dealing with it must be determined. This is especially true for water protection areas and areas where there are sources of drinking water for the supply of the population, and sanitary protection zones are not defined. With the implementation of the mitigation measures mentioned above, the impact on the environmental objective under examination from installing solar energy receivers, is expected to be insignificant.

The following issues are considered:

1 - impacts on the quality and quantity of available drinking water due to potential encroachments on water protection lands and in the vicinity of springs intended for own supply of drinking water

2 - impacts on sources of drinking water due to changes in the amount and chemical status of groundwater as a result of the interventions foreseen by INECP

Based on the above and as indicated in the table below Error! Reference source not found., it can be concluded that the INECP dimensions will have both positive and negative impact on the environmental specific objective "Ensured supply of adequate and healthy drinking water to the population ". Negative impacts can be minimized with the implementation of appropriate mitigation measures (Overall rating +/- Mixed).

Table 5.7: Identification of characteristics and significant impacts of INECP implementation on the environmental specific objective " Ensured supply of adequate and healthy drinking water to the population".

Environmental Objective	EO2. Protection and improvement of human health	Impact characterization						
		Type	Impact risk (Probability)	Intensity	Magnitude	Reversibility	Duration	Cumulative ness / Synergy
Specific Objective	**SEO 02.2 Ensured supply of adequate and healthy drinking water to the population**							
Impact assessment question	EQ2.2. Will the interventions of INECP directly or indirectly affect the supply of drinking water to the population							
Dimensions	GHG emissions and reduction	+	2	2	N/M	NR	2	1
	RES	-	1	1	G/L	R	2	1
	Energy efficiency	-	1	1	G/L	R	1	1
	Energy security	-	1	2	G/L	R	2	1
	Internal energy market	-	1	2	G/L	R	2	1
	Research, innovation and competitiveness	+	1	1	N/M	NR	2	1
Overall assessment	+/- Mixed							

5.1.2.2.3 Environmental specific objective " Reduction of noise and vibrations pollution "

Evaluation of the impact of INECP implementation

Impact of noise during construction interventions on human health

Increased impacts of noise pollution due to the implementation of INECP are expected during the construction of infrastructure / facilities such as for the production of electricity from RES - especially larger facilities such as RHPP and natural gas thermal power plants. The construction of such facilities can be extensive, complex and time-consuming. Buildings with protected spaces and noise protection zones can be exposed to construction noise. Construction may result in heavy mass transportation along site access roads. The impacts are negative, direct and short-lived and mostly reversible R and at local / regional level. Construction of wind farms requires extensive construction work, but construction usually proceeds quickly. Large hydropower plants and wind farms are interventions of such a nature and scale that they require an EIA in accordance with the legal and regulatory framework. The effects of these interventions on noise emissions will therefore be examined in more detail as part of environmental impact assessment in further phases. Also considering legal restrictions on noise during construction, the impacts of noise pollution during construction will not be significant. Noise control measures (e.g. silenced equipment / low-noise machinery, noise barriers, warning signs to identify hazardous noise areas, protective equipment, etc.) can contribute to mitigate negative impacts.

Impact of road and railway noise on human health

INECP measures related to road and rail traffic can have a negative or positive, direct, permanent, cumulative impact on noise and in some cases can have a transboundary impact. The increase in the volume of domestic and foreign passenger and freight traffic represents a potential negative impact on noise emissions.

The INECP measure - increasing the share of new technology passenger cars and buses (hybrid vehicles, electric vehicles, hydrogen vehicles) therefore has a positive impact in cities in terms of noise emissions. However, in the future, the possibility of changing the legislation of the impact of the silence of electric vehicles on safety in urban centres must be considered.

At the strategic level, it is estimated that the potential cross-border impact on the increase in noise pollution is possible in the case of individual railway and road network development projects, which are located in the area of influence or in the immediate vicinity of neighbouring countries. The potential cross-border impact of individual projects is assessed in the context of the procedures. Given the legal restrictions on noise, the impact of road and rail traffic on noise pollution will not be significant.

The impact of devices operation on human health due to noise and sound pollution

Audible sound above the permissible limit can be called excessive noise, while the inaudible sound spectrum, which has a harmful effect on human health, can be called sound pollution.

According to the International Commission on the Biological Effects of Noise (ICBEN), the amplitude of the sound modulation of wind farms has a significant impact on the disturbance of the population. Increased distress was observed in the most recent and comprehensive study of the impact of environmental noise on human health in residents exposed to an equivalent annual noise value of 35-40 dB (A). The World Health Organization (WHO) recognizes stress as a negative influence on human health. Noise from wind turbines at the same equivalent level causes more stress than traffic noise (road, rail and air), which experts from the International Commission on the Biological Effects of Noise (ICBEN) explain by the characteristic, periodic amplitude modulation of wind noise. They also found that wind farm noise disturbed residents in an otherwise quiet environment more than those living in an environment that was also otherwise noise polluted. It is important to understand that noise from wind turbines is influenced not only by noise levels but also noise characteristics, light flickering, shadow movement, vibrations, individual sensitivity, visible landscape change and personal attitudes (importance of renewable energy, value of landscape, expediency of intervention, etc). Knowing all the impacts are important when choosing mitigation measures to reduce the impact of noise and deciding on the limit values of wind farm noise in the environment. The evidence for a causal relationship between wind power noise and sleep disturbances is less robust, but this effect cannot be completely ruled out. Scandinavian and Dutch experts (ICBEN) found that exposure to wind noise is also linked to sleep disturbances and mental disorders, but only indirectly, through noise distress. It is known that noise from the environment can disturb sleep. According to the WHO, noise at night should not exceed the level of 30 dB (A).

The results for the effect of wind energy noise on stress are not sufficient to prove a causal relationship. Nevertheless, there remains the possibility of an indirect influence on stress through greater and permanent agitation. Findings on the effects of wind power noise on other health changes and symptoms, skin sensation disturbances, fatigue, headache, nausea, chest pressure, feeling of internal vibrations, dizziness/vertigo, vision problems, communication difficulties, pressure or pain in the ears, tinnitus, hearing loss, anxiety, depression, irritability, psychological stress, nosebleeds) are not sufficient to demonstrate causation. Due to the lack of evidence, a final rating cannot be given. The Expert Committee on Wind Energy Noise and Human Health notes the lack of longitudinal studies and studies dealing with the impact on children and other vulnerable groups of people. Chronic agitation and sleep disturbances are associated with the stress response in long-term studies of road, rail, and air traffic noise. These health signs are risk factors for diseases such as cardiovascular disease, so caution should be exercised even in the case of wind energy noise.

From the point of view of impact on people, the most important element is the appropriate distance of wind farms from settlements or buildings where people live permanently (apartments, schools, kindergartens, hospitals...). As the distance increases, so does the acceptability of wind farm construction in terms of human impact. As a rule, of course, by moving away from settlements, wind farms are located in an area that is more naturally preserved, burdened by less human intervention and dominated by the protective aspects of spatial planning.

For an individual intervention, a decision on the choice of technology/type of wind farm is required. Appropriate measurements are needed to better understand the impacts and make the right decisions. Four important factors are highlighted: background noise, day noise measurements, night measurements and amplitude modulation assessment. Measurements should be made taking into account the degree of amplitude modulation of the noise. It is important to carry out an assessment of the impact on the environment and human health for each individual intervention. The connection and communication of all interested parties, including the local population, is important. Participation in decision-making is necessary already at the conceptual design stage. By combining public opinion research and environmental impact assessment, many European countries have managed to reduce the controversy surrounding wind energy exploitation, mainly because local communities are involved in the process and benefit from it. Impact assessment and public participation contribute to education and greater awareness and control of new wind energy projects. In order to achieve social acceptability of the intervention, the disadvantages and advantages of the intervention and the concerns of the population must be addressed. Good practices especially refer to the establishment of limit values and safe distances.

It is recommended that wind energy technology developers consult and collaborate with local communities at a very early stage of project planning.

For an industrial installation (e.g., a wind farm) in the low frequency and infrasound range, there are no regulations that determine the minimum distances between wind farms and protected areas. At the moment, noise is subject to general environmental protection regulations that do not take into account the effects on human well-being and health due to amplitude modulated sound, low frequency sound and infrasound.

Therefore, the adoption of special standards for low-frequency sound and infrasound, which is generated during the operation of a certain device or industrial plant (e.g., wind farm) should be considered. Appropriate scientific research and insight into this area is needed in order to ensure a sufficient level of protection of human health from the negative effects of sound pollution when locating a certain number of wind farms.

Noise limits and safe distances from dwellings are set differently in different countries, based on a number of parameters. They can be set up at national, regional or even local level. Several thresholds are often set depending on wind speed, background noise, landscape value and time of day. Therefore, it is crucial that an assessment of the impact on the environment and human health be carried out for each intervention and that all actors are actively involved in the decision-making process. To assess noise in apartments, it is necessary to model the spread of noise in the environment according to the local variability of the terrain and the specifics of meteorological factors. Estimating wind power levels is a more sensitive measure of exposure because it takes into account not only wind farm distance but also topography, presence of larger bodies of water, wind farm characteristics, wind farm field area, and number at any given distance.

Placing wind farms near settlements in neighbouring countries could have cross-border impacts. The environmental report lists mitigation measures that reduce the possibility of transboundary impacts due to the construction of wind farms: wind farms are not to be located in areas where sound (the audible range of sound including low frequencies and infrasound) may adversely affect human health and well-being.

Wind farms are therefore of such a nature and scale that they require an environmental impact assessment in accordance with the Regulation in place. The effects of these interventions on noise will therefore be examined in more detail as part of the assessment. Considering this fact and taking into account the mitigation measures of the recommendations for low-frequency sound and infrasound, the effects on sound pollution during operation will not be significant.

Potential sources of noise due to the operation of gas thermal power plants include: the inlet and outlet duct of flue gases to the waste heat boiler with the boiler, the boiler chimney and auxiliary devices at the bottom of the boiler, the steam turbine with the generator, the transformer and the oil lubrication and regulation system, the gas turbine with the generator, transformer, inlet duct, gas turbine auxiliary chimney outlet (in case of open cycle) and oil system lubrication and management system, receiving filter station for natural gas, receiving station for liquid fuel and demineralized water, air intake on static air filter, exhaust diffuser.

According to the Regulation, the new noise source must not cause excessive noise pollution and it is necessary to provide noise protection measures in order to prevent and reduce noise in the environment. In this case, measures to reduce noise emission at its source have priority over measures to prevent the spread of noise in the environment.

Gas-fired power plants are facilities for which environmental consent and environmental permits must be obtained in accordance with the Law. Based on the known technology and technological data of the device, it will be possible to perform a sufficiently high-quality noise assessment with a model calculation. Considering all legal noise restrictions, the impact on noise emissions during the operation of gas power plants will not be significant.

Noise levels in 110 kV transmission lines (single-system or dual-system) in maximum operating condition are lower than 35 dBA or can be measured only in extreme conditions.

Transformer operation must comply with legal requirements. The noise intensity itself depends on the type and load of the transformer and on the temperature of the environment and its rated power and type of cooling. The direct noise of the transformer is caused by the load current that causes the lamellar plates in the core of the transformer to vibrate, and the indirect noise is caused by the operation of the cooling systems in the case of transformers with forced heat removal. In addition to energy transformers, there are also distribution plants, which are divided into individual distribution fields. All switchboards are open type, so there is also a corona, which is an occasional source of noise and together with transformers and cooling fans contributes to the overall noise level at the location of the switchboards and outside their enclosure. Considering all legal noise restrictions, the impact on noise emissions during the operation of transmission lines and switch gear will not be significant.

The following issues were considered:

1 - impact of noise during construction interventions on human health

2 - impact of road and railway noise on people's health

3 - impact of device operation on people's health due to noise and sound pollution

Based on the above and as indicated in the table below, it can be concluded that the INECP dimensions will have negligible short-term negative impact with the implementation of appropriate mitigation measures as well as positive impacts on the environmental specific goal “reducing noise and vibration pollution" (overall rating +/- mixed impact).

Table 5.8: Identification of characteristics and significant impacts of INECP implementation on the environmental specific objective " Reduction of noise and vibrations pollution "

Environmental Objective	EO2. Protection and improvement of human health	Impact characterization						
		Type	Impact risk (Probability)	Intensity	Magnitude	Reversibility	Duration	Cumulativeness / Synergy
Specific Objective	SEO 02.3 Reduction of noise and vibrations pollution							
Impact assessment question	EQ2.3. Will the INECP interventions reduce noise emissions and vibrations ?							
Dimensions	GHG emissions and reduction	0	-	-	-	-	-	-
	RES	++/-	2	2/1	N/M / G	NR / R	2/1	1
	Energy efficiency	+/-	2	2/1	N/M / G	NR / R	2/1	1
	Energy security	-	2	1	G	R	1	1
	Internal energy market	-	2	1	R	R	1	1
	Research, innovation and competitiveness	+	1	1	N/M	NR	2	1
Overall assessment	+/- Mixed							

5.1.2.2.4 Environmental specific objective " Reduction of electromagnetic radiation "

Evaluation of the impact of INECP implementation

Electromagnetic fields are a combination of invisible electric and magnetic fields of force. They are generated by natural phenomena, but also by human activities, mainly through the use of electricity. Exposure to electromagnetic fields triggers immediate biological effects if they are strong enough.

Effects range from stimulation of nerves and muscles to heating of the body tissues, depending on the frequency. In response to growing public health concerns over possible health effects from exposure to an ever-increasing number and diversity of electromagnetic field sources, in 1996 the World Health Organization (WHO) launched a large, multidisciplinary research effort. Based on a recent in-depth review of the scientific literature, the WHO concluded that current evidence does not confirm the existence of any health consequences from exposure to low level electromagnetic fields[40].

The intensity of the electric field is measured by the unit measure "Volt per metre" (V/m) and it may vary depending on the differences of potentials between the conductors, the land and the near-by objects. The concept of density of flux (magnet induction) is used for describing the magnetic fields. These fields are measured by the unit measure "Tesla" (T). The power of EMF from transmission lines depends on the voltage level of the line and it decreases with the increase of distance from the conductors.

The general public can be exposed to extremely low frequency (ELF) fields from various fixed sources that are operated in the environment, such as power lines. When people are passing directly below a high voltage powerline, they can be exposed to an electric field between 2 to 5 kV/m and to magnetic fields of less than 40 μT. The strength of the electric and magnetic field diminishes rapidly with distance to the line.

Low voltage power lines cause much lower exposure (100-400 V/m and 0.5-3 μT), and buried cables virtually none. Power plants and distribution stations are off limits to most people and so are not considered a source of exposure for the general public. The same goes for railway power supply installations. The exposure levels in the areas that are accessible to the public should be below applicable limits[41].

The level of limit values for exposure to EMF according to the 1998 guidelines of the International Committee for Protection from non-ionic Radiation, which are a reference level, are:

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[40] https://www.who.int/news-room/questions-and-answers/item/radiation-electromagnetic-fields
[41] https://ec.europa.eu/health/ph_risk/committees/04_scenihr/docs/scenihr_o_007.pdf

General Public exposure:

- Electric fields: 5 kV/m
- Magnetic fields: 100 μT

Occupational exposure:

- Electric fields: 10 kV/m
- Magnetic fields: 500 μT

The Law on Protection from Non-Ionizing Radiation (Official Gazette of the RS“, No. 36/09), regulates the conditions and measures for protecting human health and the environment from harmful effects of the non-ionizing radiation in Serbia; this law prescribes all necessary conditions, standards, monitoring and inspection, technical and other rules aimed to offer a complete protection of the population and environment from non-ionizing radiation side-effects on the territory of the Republic of Serbia. The way of examining the EM field is regulated in greater detail by the secondary legislation,through the Rulebook on Limits of Exposure to Non-Ionizing Radiation ("Official Gazette of the RS" No. 104) which prescribes the limits of exposure to non-ionizing radiation, the basic limitations and reference limit levels of exposure of the population to electric, magnetic and electromagnetic fields of different frequencies that can be considered as safe for the population’s health. During the examination of the EM field, the obtained results are compared with the reference field levels and, accordingly, the appropriate protective measures are taken.

INECP anticipates the necessary construction of new HV transmission lines 110, 220 and 400 kV and HV transformer stations. Adopting a precautionary approach, the location of infrastructure should particularly avoid proximity to sensitive zones of special interest (schools, kindergartens, hospitals, etc.). In case these areas cannot be avoided mitigation measures such as appropriate design solutions must be adopted. Appropriate monitoring and measuring activities for the levels of EMF in certain potentially critical sites and control the possible exceeding of the limit values of exposure should also be put in place. Specific mitigations measures are expected to be put in place following the implementation of project specific EIAs.

The following issues were considered:

1 - Impact of EMS from electricity production units and their connection to the power grid

2 - The impact of EMS due to the promotion of rail transport

3 - Impact of EMS due to operation of transmission and distribution power infrastructure

Based on the above it can be concluded that the INECP dimensions will have no significant negative impact on the environmental specific goal "Reduction of electromagnetic radiation " with the implementation of regulation in place as well as any additional prevention or mitigation measures specified in the EIAs to be developed for the relevant infrastructure projects (Overall rating 0 neutral) .

Table 5.9: Identification of characteristics and significant impacts of INECP implementation on the environmental specific objective "Reduction of electromagnetic radiation "

Environmental Objective	EO2. Protection and improvement of human health	Impact characterization						
		Type	Impact risk (Probability)	Intensity	Magnitude	Reversibility	Duration	Cumulativeness / Synergy
Specific Objective	SEO 02.4 Reduction of electromagnetic radiation							
Impact assessment question	EQ2.4. Will the interventions contained in the INECP directly or indirectly lead to increased electromagnetic radiation exposure of the population?							
Dimensions	GHG emissions and reduction	0	-	-	-	-	-	-
	RES	0	-	-	-	-	-	-
	Energy efficiency	0	-	-	-	-	-	-
	Energy security	0	-	-	-	-	-	-
	Internal energy market	0	-	-	-	-	-	-
	Research, innovation and competitiveness	0	-	-	-	-	-	-
Overall assessment	0 Neutral							

5.1.2.2.5 Environmental specific objective "Waste reduction and adequate treatment and disposal of waste"

Evaluation of the impact of INECP implementation

Improper collection, treatment or disposal of waste can have a significant and long-term negative impact on the environment, especially on groundwater and soil, which can affect the quality of drinking water and soils, which are critical for supporting human health. The activities planned by INECP generate waste of several types, regulated by various by-laws, most of which are non-hazardous and inert waste types.

Waste expected to be generated includes:

- Ash and slag from burning coal;
- Construction and demolition waste from development of new facilities and infrastructure, potentially containing dangerous substances;
- hazardous and non-hazardous waste from increased production in all industries
- Scrap vehicles at the end of their life;
- Used batteries that will have to be recycled in an efficient and economical way linked to the increased number of electric vehicles;
- Upgrading the railway network can lead to:
    - larger amounts of waste stone fractions and
    - waste railway sleepers, which can be a source of dangerous substances;
- Old combustion devices used for heating homes and in various industries;
- E-waste can be expected after the use of solar panels linked to the development of solar power plants;
- Sludge that accumulates in the storage lakes in front of the HPP, RHPP and MHPP dams;
- Formation of digestate or digestate sludge, which is a semi-liquid or liquid material produced by anaerobic digestion from biogas plant;
- Radioactive waste from the planned NPP.

INECP proposes several interventions in the field of waste:

- Measures for the improvement of waste management practices
- Promotion of reuse and recycling and reduction of the amount of generated waste (including through promotion of circular economy);
- Upgrade of the recycling infrastructure

- Awareness raising projects with regards to waste
- Exploitation of the available potential in the biological treatment plants and the organic residue of municipal waste
- Ensuring conditions for the use of compost and digestate from waste treatment;
- Capture and use of landfill gas;
- Exploitation of waste heat in the industrial sector
- Circular product design
- For the ash and slag produced by burning coal, with the stoppage of operation of certain coal blocks, the overall impact decreases;
- Promotion of GHG emissions reduction in the legislative framework relevant to waste management;
- Improvement of the packaging waste collection system;

The legislative framework regulating waste management in Serbia has been formally established; in the future, considering the expected increase in the amounts of certain types of waste, challenges may however arise. In particular, the capacities for appropriate management of electrical and electronic equipment waste, waste batteries and accumulators should be ensured.

New facilities for the thermal treatment of waste (locations of incinerators) should also be defined. For this reason, it is necessary to further speed up the activities to solve the problem of waste that cannot be reused or recycled and provide an appropriate method of thermal waste treatment to obtain heat and electricity.

Considering the expected implementation of all the necessary procedures relevant to spatial planning, EIA for individual plans or projects and the obtention of environmental permits for waste management, as well as the implementation of appropriate mitigation measures, it is estimated that the impact of INECP on the environmental specific objective will be minimized.

The following issues were considered:

1 - generation of large amounts of construction waste for the construction of infrastructure and facilities

2 - cessation of operation of individual coal blocks, leading to a reduction of the amount of ash and slag produced during coal combustion

3 - increased amounts of used batteries due to the increased electrification of transport

4 - potential negative impacts due to the generation of large amounts of sludge that accumulates in reservoirs in front of hydroelectric dams

5 - formation of digestate from biogas plant

6 - storage of radioactive waste

7 - increase of quantities of photovoltaic panels after the end of their life cycle

Based on the above and as indicated in the table below, it can be concluded that the INECP dimensions will have from strongly positive to negligible negative impact on the environmental specific objective "Reduction of waste, adequate treatment and disposal of waste". Negative impacts can be prevented and/or mitigated with the implementation of appropriate measures (overall rating +/- Mixed impact).

Table 5.10: Identification of characteristics and significant impacts of INECP implementation on the environmental specific objective "Reduction of waste generation, adequate treatment and disposal of waste"

Environmental Objective	EO2. Protection and improvement of human health	Type	Impact risk (Probability)	Intensity	Magnitude	Reversibility	Duration	Cumulative ness / Synergy
Specific Objective	**SEO 02.5 Reduction of waste generation, adequate treatment and disposal of waste**							
Impact assessment question	EQ2.5. Will the INECP interventions reduce waste generation and promote adequate treatment and disposal of waste affecting the health of the population?							
Dimensions	GHG emissions and reduction	++	2	2	N/M	NR	2	1
	RES	+/-	2	2	N/M / G	NR / R	2/1	1
	Energy efficiency	+/-	1	1	N/M / G	NR / R	2/1	1
	Energy security	-	1	1	G	R	1	1
	Internal energy market	-	1	1	R	R	1	1
	Research, innovation and competitiveness	+	1	1	N/M	NR	2	1
Overall assessment	+/- Mixed							

5.1.2.3 *Environmental Objective "Prevention and management of natural and other disasters"*

5.1.2.3.1 Environmental specific objective "Prevention of natural and anthropogenic technological disasters"

Evaluation of the impact of INECP implementation

- Interventions in flooded areas

Flood risk management is an extremely important segment of water management, which, given the fact that floods cannot be completely prevented or be completely safe from them, includes activities that help reduce the likelihood of floods and reduce the potential consequences in the event of a flood. Floods, especially more intense and long-lasting ones, can also cause chain accidents such as:

- Environmental pollution or uncontrolled leakage of dangerous substances in the environment;

- Pollution of drinking water;
- Interruption in electricity supply;
- Interruption of communication services;
- Disruptions and interruptions in the supply of drinking water;
- Occurrence of infectious diseases in humans;
- Occurrence of particularly dangerous diseases and other animal diseases;
- Infrastructure damage (damage and demolition of high dams, bridges, culverts, etc.).

The strategic environmental assessment in question deals with potential INECP measures that are not spatially defined, so at this level it is not possible to determine their potential impact on worsening the risk of flooding. The impacts of specific interventions on flood risk will be assessed in more detail within spatial planning procedures, when more detailed project data will be known from a technological and spatial point of view, depending on the type of spatial intervention and flood risk class.

Transport and energy infrastructure

Road and rail traffic measures can have potential direct and long-term effects on the achievement of this environmental specific objective "Prevention of natural and man-made disasters and limitation of their consequences due to possible leaks (applies to both new constructions and reconstruction of existing infrastructure lines and facilities) in flood areas or due to water flow regulation, changes in hydrological conditions in the area, including reduction of retention areas. In addition, such interventions may also have a cumulative impact on other existing or planned projects in flooded areas.

When locating the transport infrastructure in the area, it should be avoided placing facilities in flood areas, also associated with erosion. In the case of intervention in these areas, it must be proven that the existing level of flood risk in the wider area will not worsen, or measures to prevent deterioration must be provided. This orientation should be considered in order to limit the pressure of infrastructure on flood risk areas and to ensure that the level of flood risk in certain areas does not increase.

As part of the traffic infrastructure, a number of different measures are planned that will contribute to the promotion of sustainable rail and road traffic. The extent of the measures varies between scenarios, but all are subject to the same conditions and limitations. In addition, these measures can have a positive impact, as they often provide flood protection for settlements that are in the flood risk zone.

Hydropower plants

Locations of HPP dams in the water environment increase the risk of flooding in the zone of influence of large HPPs due to the risk of flooding due to inadequate operation of HPPs, non-compliance with extreme events due to climate change on the watercourse and the risk of flooding due to the collapse of the dam. Consequently, the construction of a new HPP requires the implementation of anti-flood measures. Flood safety can also be provided independently of HPP construction, in a sustainable manner that improves the ecological status of surface and groundwater. In addition, the construction of HPP retention basins reduces spill areas. The risk of flooding due to the collapse of the HPP dam is small, but cannot be ruled out, while the risk of flooding due to inadequate operation of the HPP should be given more attention, especially since the current frequency of periods of extreme rainfall.

The priority function of large HPPs is the control of the water flow regime downstream of the dam and thus significantly reducing the risk of flooding downstream, and the secondary function is the production of electricity. It is reasonably expected that water regulation in the area of these HPPs will reduce the existing risk of flooding.

Possible interventions within the framework of the HPP arrangement also permanently change the runoff conditions in a wider area (remote influence). HPPs can therefore affect the risk of flooding, so measures must be taken in planning to ensure that the risk of flooding in the wider area does not worsen.

Based on the available data, it can be assumed that the HPP facilities considered in INECP will be in the class of low, medium and high flood risks.

RHPP Bistrica should work according to the principle of flow accumulation with daily flow equalization.

The impact of large HPPs and other planned infrastructural facilities on human health is assessed as insignificant in terms of exposure to the risk of flooding in the conditions.

Potential new sources of disasters

Based on the analysis of potential new sources of disasters arising from the planned INECP measures, it can be identified:

- Increasing the number of solar power plants;
- Increase in the number of wind farms;
- Increasing the use of electric cars and trucks;
- New plants at risk for the environment (biogas and hydrogen production, gas network and new gas power plants).

Solar power plants

Modern solar power plants (SPP) have an estimated lifetime of 25 years and more. During that time, they are exposed to normal weather conditions (rain, wind, snow, temperature changes, aggressive gases in the atmosphere), but they also have to withstand extreme weather events (stormy winds, hail, etc.). Components of solar power plants can also harm animals (rodents, birds...). Damage can cause an electric arc, which is a source of ignition. One of the very common causes of fires in buildings is lightning strikes, so when building a solar power plant, lightning protection must be provided, which must be in accordance with the regulations on the protection of buildings against lightning strikes.

It is generally accepted that parts of solar power plants are flammable, so they can contribute to the spread of fire, which can affect the environment, directly on the quality of the ambient air and indirectly due to the deposition of dust particles on other components of the environment. How much they contribute to the fire depends on the characteristics of the building and the protective measures taken. Solar power plants relate to the following aspects of fire risk:

- Electric; An electric arc can occur as a result of failure, improper design or damage to SPP electrical installations. Due to the high temperatures generated by the arc, flammable materials in the environment burn;
- External; Fires can occur for various reasons. If the SPP is an obstacle to effective extinguishing or if the combustible parts of the SPP further spread the fire, the consequences of a fire due to SPP are greater than they would otherwise be;
- Risk; The effectiveness of extinguishing in a facility with SPP depends on its implementation. Where solar generators and DC circuits are exposed to fire, firefighters must be careful not to endanger live parts.

Due to the nature of solar power plants surrounding residents and firefighters are exposed to additional hazards in the event of a fire. Here are some key factors that increase the level of danger:

- There is a risk of electric shock, because the power plant is capable of producing electrical voltage as long as light falls on the panels, which can lead to electric shock and electric arcs in case of insulation damage;
- Combustion releases toxic gases, because the materials that make up solar power plants include glass, silicon, metals, heavy metals, liquid resin, ethylene, vinyl acetate, silicone, foils and various other plastics;
- There is a risk of the SPP collapsing and additional parts falling if the solar panel supports overheat and slide down the roof;
- There is also an increased risk that the additional load on the SPP will lead to a faster collapse of the roof;
- The risk of fire spreading also increases, because the panels placed on the roof obstruct the access of fire-fighting water to the roof, and the space between the roof and the panels causes a chimney effect and thus faster access to fresh air.

To ensure fire safety, it is crucial to choose the right elements of the solar power plant that match its load and that match the fire protection concept of the building. Aware of this danger, with the development of technology, devices have appeared that protect users and the solar power plant. Therefore, the installation of a solar power plant on an existing building must take into account the existing concept of fire protection and starts from the fact that the level of fire protection in the building does not decrease. In a new building, the solar power plant is a set of installations or a system that is integrated into the concept of building fire protection.

With SPP fire protection systems, it must be ensured that they meet the requirements of the standard in terms of the loads they are exposed to, in order to avoid damage that can cause a fire.

The predicted increase in the number of solar power plants represents a potential increase in the possibility of fire outbreaks, but it can be mentioned that the probability of fire is reduced to an acceptable level if all fire protection measures are taken during the lifetime of the solar power plant. In addition, current technological solutions ensure a high level of fire protection. It is estimated that the impact of the intensive installation of solar power plants on the potential increase in fire risk will not be significant.

Wind farms

In the case of the operation of wind farms, there are several types of potential hazards that can consequently have a negative impact on both human health and property. It can be highlighted:

- Oil spillage (for older versions of wind turbines and oil derivatives contained in individual wind turbines);
- Explosions, pole breaks, rotor fractures;
- Ignition of a fire in a natural environment due to a broken pole or a windmill explosion.

Modern wind farms work automatically and do not need a reducer like older wind farms, which contained significant amounts of oil (about 200 litres). There are no other dangerous substances in the operation of these power plants. That is why the impact of an accident at wind farms, which could affect groundwater and drinking water due to the possible spillage of oil or other dangerous substances, is very small.

In addition, in order to reduce the risk of fire due to wind turbine breakdowns, it is necessary to maintain the areas under the windmill poles and beyond, which reduces the possibility of fire spreading to forest areas.

Passenger and freight traffic

INECP predicts an increase in electricity consumption in the area of passenger and freight traffic. This also indicates an increase in the number of electric vehicles by 2030, and also by 2040 and 2050.

The increase in the number of electric and hydrogen powered passenger cars and trucks will also increase the risk of fires. In the case of the use of electric vehicles, there are two causes of ignition, namely self-ignition caused by loose and oxidized contacts and accidental ignition. In order to reduce potential fire hazards, the use of good charging cables and quality installation will be of crucial importance, which will prevent fires in garages during charging.

The greater risk of ignition of electric vehicles is traffic accidents, where a strong collision, which crushes the battery housing, can lead to so-called thermal escape, which can cause the vehicle to catch fire. However, once the battery is ignited, it is difficult to turn off the car, because the chemical composition of the cell makes it difficult to extinguish and re-ignite.

It should be noted that newer versions of electric cars and trucks already have built-in safety systems that are activated in the event of damage to any high-voltage component. Analysis of electric cars show that such accidents are few, and almost all are the result of serious traffic accidents. This has encouraged manufacturers to better protect the battery pack from possible damage. One of the self-ignition risk statistics made in Germany states that the risk of self-ignition in electric vehicles is 10 times lower than in vehicles with conventional engines.

Electric cars and trucks are still perceived as a novelty, so it is necessary to check the risk of fire and confirm it with the appropriate standards. In order to increase the efficiency of extinguishing electric vehicle fires, it will be necessary to provide appropriate training for firefighters.

The use of hydrogen as a fuel for passenger cars is currently lagging behind. One of the reasons is the currently poorly developed network of hydrogen pumps. In addition, the introduction of hydrogen technologies in motor vehicles requires the development of specific safety concepts. As with other activities, areas of increased risk should be assessed and reduced to a socially acceptable level. All major stages of work should be reviewed and examined. As new technologies bring with them new risks, new standards and norms need to be developed to ensure safe use.

Production of biogas, hydrogen, gas network

One of the objectives of INECP is to establish technical, legislative and stimulating economic conditions for the decarbonisation of natural gas supply in Serbia. In order to achieve this objective, the following activities will need to be supported:

- Sustainable production, purification and introduction of biogas into the distribution and transmission network;
- Usage of carbon dioxide which is captured by organic processes or from the air;
- Production and injection of hydrogen obtained by electrolysis using (renewable) electricity, taking into account the technical limitations of the system and users (up to 1 % participation).

Also, livestock manure represents the potential for biogas production. Biogas production is a well-known technology. However, due to the explosiveness of the gas, it represents a source of risk. Taking into account the safety regulations related to the construction and the relevant standards for the installed equipment, the occurrence of an accident is unlikely.

A theoretical calculation shows that cattle, pig and poultry manure could produce 315 GWh of electricity and 245 GWh of heat energy. Due to relatively small farms and their dispersion, only about one third of this potential is technically usable, and currently, according to rough estimates, 0.2 % of the potential of cattle manure, 13.8 % of the potential of pig manure and 5.8 % of the potential of poultry manure are exploited.

Among the planned new facilities is a natural gas thermal power plant, but currently, due to the lack of knowledge about the size of the production capacity of the plant or equipment, it is impossible to predict whether they belong to SEVESO plants. When locating new plants and facilities, attention must also be paid to the locations of existing plants and equipment and it should be situated at appropriate safety distance, thereby reducing the risk of a chain effect. In addition, when locating interventions that are not sources of accidents, but approaching the existing SEVESO installations, their protection zones must be taken into account and, if necessary, their location adjusted in accordance with the criteria for determining the minimum distance between the installation and spaces where more people are living and there is infrastructure.

Therefore, in the next stages of design, when deciding on the location and technological solutions, it will be necessary to carefully consider all the criteria that will ensure the least environmental risk, taking into account the stricter environmental legal provisions.

INECP dimensions aim to increase production from renewable energy sources. Therefore, the number of facilities that can increase the risk of flooding (e.g., HPP, road and railway network) is increasing. In addition, it is planned to increase other installations that are a potential source of other accidents (e.g., fires, breakages and other types of accidents due to solar power plants, electric vehicles and wind farms). The proposed mitigation measures will ensure that their impact is negligible.

Finally, it is worth noting that although there may be negative impacts on the specific environmental objective from proposed activities, the move away from the use of lignite for energy production and the development of new improved facilities and infrastructure in line with environmental protection laws and regulations in place and based on responsible planning and implementation has a significant positive effect on the specific objective under examination.

The following issues were considered:

1 – potentially significant impact on flood safety due to the location of new road, railway and energy infrastructure,

2 – potentially significant risk of accidents due to the construction of new HPPs,

3 – potential increase in the risk of fire due to the increase in the share of electric vehicles (cars and trucks),

4 – potential increase in the risk of fire due to the intensive installation of solar power plants,

5 - potential increase in the possibility of accidents due to the intensive installation of wind farms.

Based on the above and as indicated in the table below, it can be concluded that all INECP dimensions will have a negative impact on the environmental specific objective "Prevention of natural and anthropogenic-technological disasters " (overall rating - Negative impact) which can be ameliorated with the implementation of appropriate prevention and mitigation measures.

Table 5.11: Identification of the characteristics of significant impacts of the implementation of INECP on the environmental specific objective "Prevention of natural and anthropogenic – technological disasters"

Environmental Objective	EO 03. Prevention and management of natural and other disasters	Impact characterization						
		Type	Impact risk (Probability)	Intensity	Magnitude	Reversibility	Duration	Cumulative ness / Synergy
Specific Objective	SEO 03. Prevention of natural and anthropogenic- technological disasters							
Impact assessment question	Will the INECP interventions improve safety from floods and risk of fire?							
Dimensions	Reduction of GHG	+	1	2	G	NR	2	1
	RES	-	1	2	R	NR	2	1
	Energy efficiency	+/-	1	2	G	NR	2	1
	Energy security	+/-	1	2	G	NR	2	1
	Internal energy market	-	1	2	G	NR	2	1
	Research, innovation and competitiveness	?	-	-	-	-	-	-
Overall assessment	- Negative							

5.1.2.4 Environmental Objective "Protection of surface and ground water, (morphology, ecological status, quantity and quality)"

5.1.2.4.1 Environmental specific objective "Improved status or ecological potential of water bodies including surface water and groundwater "

Evaluation of the impact of INECP implementation

- Description and assessment of the impact on the surface water chemical status

INECP envisages the construction of two RHPPs. The construction of large RHPPs may have a negative impact on the chemical status of watercourses and ecological standards for organisms during construction (short-term impact) as a result of earthworks, including downstream (long-term impact) if appropriate prevention and mitigation measures are not in place. Water silting can also occur during RHPP operation (permanent impact) as a result of altered hydrological conditions and sediment and silt movement. This can lead to an increase in solids in the water column, which can lead to the washing of certain components of solids (e.g., organic matter and potentially present pollutants), a lack of oxygen and an increased concentration of nitrogen and sulfur compounds (indirect effect). This, together with other sources of pollution where present (e.g., agricultural and industrial discharges), can have a cumulative effect of increasing the concentration of pollutants in the watercourse.

INECP also foresees an increase in the capacity of electricity production from small hydroelectric power plants (MHPP). Specific locations/areas for small hydropower plants in INECP have not been defined. The implementation of MHPP can have similar effects on the chemical status of surface water bodies, although on a smaller scale in the absence of appropriate prevention and mitigation measures. The implementation of INECP envisages the priority improvement of modernization and revitalization of existing MHPPs, and possible new MHPPs are connected to existing dams in watercourses. Significant impacts on the chemical status of water during the construction of small hydropower plants are therefore less likely.

According to INECP, the installation of a new gas-steam power plant on natural gas is expected. Location is not defined. The implementation of PPE can have a direct remote influence on the parameters of the chemical status of surface waters due to the discharge of technological wastewater and an indirect remote influence on the chemical status of surface waters due to the capture of water for cooling in the steam condensation process. Refrigerant wastewater is usually not contaminated. However, the discharge of heat-loaded cooling wastewater can increase the temperature in the water stream, which can lead to a decrease in the amount of dissolved oxygen in the water and thus reduce the water's ability to oxidize organic pollutants (indirectly, possibly synergistically). The extent of the impact largely depends on the location of the project, the affected watercourse and the chosen technical solutions. In the case of other sources of pollution in the vicinity (discharge of industrial wastewater from other sources, agricultural sources) there may also be cumulative effects on the chemical state of watercourses if appropriate measures are not put in place.

Large hydropower plants are interventions of such a nature and scale that they require an environmental impact assessment in accordance with national Regulation. The effects of these interventions on the chemical state of the water will therefore be examined in more detail as part of assessments in further planning procedures.

INECP envisages the direct use of thermal water, which is mostly discharged into existing public sewers or surface watercourses for existing users. INECP foresees a further increase in the direct use of thermal water. The discharge of energy-using thermal water into wastewater can affect the chemical state of the surface water into which the wastewater is discharged (the load of microbes and pollutants naturally present in the thermal water). Thermal wastewater is considered industrial wastewater and its pollution is legally limited and regulated by issuing environmental permits. Further use of geothermal waters and their increase is acceptable only if mitigation measures are in place.

INECP predicts an increase in the volume of production in the industry. The increase in industrial production can have a direct impact on the chemical status of water due to the increased discharges of pollutants in the water.

The chemical state of surface waters can be negatively affected by the construction and operation of roads (discharge of wastewater, accidents involving the spilling of hazardous substances). Verification of the compliance of potentially caused additional emissions into water at certain locations is checked in environmental impact assessments at lower planning levels or in procedures for obtaining environmental permits.

INECP predicts a large increase in the area of solar energy receivers. Energy-efficient use of solar receivers also requires periodic cleaning of the receiver. The treatment process generates wastewater that can be contaminated with detergent residues and substances removed from the receiver surface during the treatment process, especially dust deposits that can be contaminated with various pollutants that are part of the dust deposits. This type of wastewater must be discharged into a public sewer that ends with a municipal wastewater treatment plant. If this is not possible, before releasing it in the environment, the properties of this type of wastewater from panel cleaning must be checked, and based on the results of the analysis, the method of dealing with it must be determined. If it is considered the measures mentioned above to mitigate the impact of installing solar energy receivers on the environment, the impact on this specific objective is insignificant.

- Description and evaluation of the impact on the surface water ecological status

Hydropower can have significant negative impacts on the ecological status of surface waters. The key potential impacts of storage and run-of-river hydropower plants on the ecological status of surface water bodies are:

1. Changes in the shape of the riverbed and the hydrological regime

The construction of hydroelectric power plants, the construction of dams, storage basins and embankments can lead to a permanent change in the shape of the bed, the composition of natural structural elements and the permanent placement of the dam in the watercourse bed. When the hydrological regime (amount and dynamics of water flow) changes, there may be a significant change in the type of river. Due to the filling and emptying of the reservoir and the change in flow (even several times a day), there are frequent fluctuations in the water level downstream. Non-reversible negative, direct and indirect and cumulative effects on the hydro-morphological elements of the quality of surface water bodies (hydrological regime, flow continuity, morphological conditions) are expected.

2. Changed sediment dynamics

Reduced flow velocity in the reservoir can increase the sediment load (larger particles are usually deposited at the beginning of the reservoir, smaller particles closer to the dam, and the smallest particles cross the dam), and on the other hand prevent deposition and transport of sediment downstream. As a result, the bed deepens downstream of the dam. Greater sediment movement is only at high water. Long-term direct, indirect and cumulative impacts on hydro-morphological and biological quality elements are foreseen: morphological conditions, benthic invertebrates, macrophytes, algae and fish.

3. Changed physical and chemical conditions (temperature, oxygen concentration)

A decrease in water flow upstream of the dam can lead to an increase in water temperature and a decrease in oxygen concentration, as well as a decrease in the river's self-cleaning capacity. Stratification of water in reservoirs with significantly higher surface temperatures and lower temperatures deeper in the reservoir can be expected. Physicochemical conditions can also be indirectly affected by the accumulation (elsewhere) of contaminated sediments or silt in the dam and permanent hardening of the water. This can be intensified in cases of mechanical movement of sediments to maintain HPP flow. Long-term direct and cumulative effects on physicochemical parameters are expected.

4. Changed structure and function of habitats and species, interrupted ecological continuity

In the zone of construction of hydroelectric power plants, the main bed usually dries up, and in the drained part of the bed, the association of aquatic organisms is destroyed. The riverbed in this area leads to a channel to divert the flow. As a result of construction and earthworks in the dam construction zone, the water may become cloudy downstream from the works, which may negatively affect aquatic organisms. Short-term effects on biological quality elements are expected: aquatic vegetation (phytoplankton, phytobenthos, macrophytes), benthic invertebrates, fish.

After the construction of the facilities, a new association of aquatic organisms adapted to the new hydrological regime is established. Due to the changed width and depth and the reduced river habitat, the species composition in the area upstream of the dam can change from the river type to the standing type. Built embankments change the structure of the coastal zone, which is basically homogeneous and can therefore be characterized by a low diversity of coastal habitats. Slow water flow in the dam, together with leaching of nutrients from the catchment, can lead to eutrophication in the reservoir. Increased water depth and water turbidity change lighting conditions, which can also help increase eutrophication. The accumulation of organic matter and their decomposition also affect the oxygen content in the sediments. This, together with silting of the riverbed and increased deposition of sediment, can lead to changes in the benthic invertebrate community and changes in the circulation of matter.

Migratory species of aquatic organisms, such as fish, may be affected by habitat fragmentation. This can lead to the impoverishment of the genetic pool of populations. Upstream of the dam, lower flow velocities can affect fish due to disorientation. Downstream of the dam structure, aquatic organisms (macrophytes, benthic invertebrates, fish) may be affected due to the reduction of natural sediment movement. Due to frequent fluctuations in the water level downstream of the dam, a sudden drop in the water level of the river can lead to an increase in the pressure of the groundwater on the sediments, and thus to repeated effects on fish embryos and benthic organisms. They are also affected by the very speed of the water flow in case of a sudden increase in the water flow.

Such impacts decrease with distance from HPP. Therefore, permanent, local effects on biological quality elements are expected: aquatic vegetation (phytoplankton, phytobenthos, macrophytes), benthic invertebrates, fish.

The extent and intensity of the identified impacts largely depend on the type of hydropower plant and the specific location of implementation. Accumulation HPPs have, in principle, greater impacts arising from the location of the storage basin than flow-accumulation power plants. In the case of derivation power plants, where the hydraulic drop creates a derivation canal that connects the dam to the downstream engine room, we can expect additional impacts on the ecological status of the water due to additional facilities (canal, engine room) and large obstacles to ensure an environmentally acceptable flow.

Determining an exemption for an individual water body must not jeopardize the achievement of objectives related to the good status or good ecological potential of waters in other water bodies within the same water area for which no exemption is provided.

The construction of small HPPs can have similar effects on the ecological status of surface water bodies, but on a smaller scale. MHPPs are usually installed on smaller watercourses, which means greater vulnerability to small-scale interventions. When installing several HPPs in predominantly untouched parts of watercourses, the specific impacts of HPPs (per KWh of energy produced) on the ecological status of watercourses can be greater than the impact of large HPPs. In the case of derivation MHPPs, excessive abstraction of water from watercourses (ensuring an environmentally acceptable flow) can be particularly problematic. Even in the case of MHPP, it is necessary to determine in the planning stage whether the exemption from the derogation from the environmental objectives should be applied to the water bodies on which they are planned.

The INECP follows the assumptions that, in order to minimize negative impacts on nature, the development of the MHPP network takes place in such a way that the upgrading and modernization of existing MHPPs and the revitalization of existing, non-functional MHPPs have priority over implementation of new MHPP, which should be connected to the existing structures of dams in watercourses. These assumptions significantly limit the impacts on the ecological status of watercourses and can be further reduced with mitigation measures.

The implementation of natural gas power plants can also have a potentially significant impact on the ecological status of water, which can affect the ecological status of surface waters if water is abstracted from surface watercourses for cooling plants. Capturing and conducting water into the condenser leads to the death of microorganisms, which can affect the nutrition of other organisms in the water stream. The discharge of heat-loaded cooling wastewater can lead to an increase in the temperature in the watercourse, which can lead to the death or lower fertility of certain species of organisms and a higher probability of the growth of invasive species of organisms. At higher temperatures, organisms have an increased metabolic rate, which requires higher oxygen consumption. The proportion of dissolved oxygen in water decreases with increasing temperature. Discharge of spent water from geothermal aquifers can have a similar effect on watercourses if it is done without reinjection and if the wastewater is not cooled and cleaned before discharge into the watercourses. The implementation of appropriate prevention and mitigation measures is key to the reduction of potential negative impacts.

Large hydropower plants and gas-fired power plants are interventions of such a nature and scale that they require an environmental impact assessment in accordance with the Regulation. Specific locations are only acceptable if an impact assessment at lower planning levels shows this. The effects of these projects on the ecological status of surface waters will be examined in more detail as part of assessments in further planning procedures. The impacts of the use and discharge of thermal wastewater are regulated within the framework of obtaining concessions for the use and environmental permits for the disposal of wastewater.

INECP predicts an increase in the volume of production in the industry. The increase in industrial production can have direct and indirect effects on the ecological status of waters due to increased emissions of pollutants into waters or in the case of interventions in waters or coastal lands.

The ecological status of surface waters can also be affected by the construction of traffic infrastructure, mainly due to potential interventions on water and coastal land. Verification of the compliance of potentially caused additional emissions into waters or interventions in waters and coastal land at certain locations are verified at lower planning levels or in assessments of the impact of projects on the environment or in procedures for obtaining environmental permits or water consents.

INECP also foresees the promotion of biogas production. Biogas production generates digestate (digested sludge), which can be used as fertilizer. Emissions from biogas plants and improper use of digestate can lead indirectly to pollution of surface water with nitrates (through soil and groundwater pollution).

Measures in place aimed at improving wastewater treatment and discharge as well as measures aimed at improving waste management through the promotion of recycling and circularity are expected to have a positive contribution to the objective under examination.

Based on the above, it can be concluded that overall, INECP may have negative impacts on the environmental specific objective "Improved status or ecological potential of water bodies including surface water and groundwater" if left unmitigated. The EIA, environmental and water permit requirements will contribute at a later stage a more concrete and detailed assessment as well as play a key role in preventing and/or minimizing potential negative impacts.

- Effects on the chemical status of groundwater

The implementation of the measures provided by INECP may affect the chemical status of groundwater due to possible accidents and spills of dangerous substances (petroleum derivatives, lubricating oils) during the execution of earthworks on infrastructural facilities if appropriate measures are not in place. Groundwater pollution can be affected by the operation of windmills in case of spills or leakage of lubricating oil and hydraulic oils. Infrastructure interventions and the construction of wind farms above 10 MW are interventions that require an environmental impact assessment in accordance with the Regulation. Taking into account the mitigation measures resulting from these assessments and the measures prescribed by law, the effects of these interventions on groundwater are expected to be insignificant. The impacts of individual wind farm locations on groundwater status are assessed as part of environmental impact assessments at lower planning levels by conducting environmental impact assessment.

Due to the potential rise of groundwater during the operation of hydropower plants, there may be an increase in the sensitivity of groundwater to pollutants from the surface (indirect, remote, synergistic and permanent impact). An increase in the vulnerability of groundwater may also be a consequence of the negative effects of HPP on the interstitial fauna, which plays an important role in the treatment of groundwater. The construction of large HPPs implies interventions that require an environmental impact assessment in accordance with the Regulation. In these procedures, it is necessary to examine the possible effects of individual HPPs on increasing the risk of groundwater pollution in relation to the presence of other sources of groundwater pollution (e.g., pollution from agriculture).

Excessive use of geothermal energy from deep geothermal sources can lead to lower groundwater temperatures. The impact can be cross-border (aquifers are shared with BiH, Croatia and Hungary). Similarly, the use of heat from a water-water HPP (use of heat from a shallow aquifer) with extensive, concentrated, irrationally planned and long-term use of this energy source can reduce the temperature in the shallow aquifer and thus reduce the energy efficiency of users (indirect impact on water use). Decreasing temperature of shallow aquifers can also affect biodiversity (indirect impact on underground fauna).

INECP predicts an increase in the volume of production in the industry. An increase in industrial production can have a direct impact on the chemical status of groundwater in case of discharge of pollutants into groundwater. The chemical state of groundwater can also be negatively affected by the construction and exploitation of roads (discharge of wastewater, accidents involving the spillage of dangerous substances). In accordance with the legal restrictions for wastewater disposal, there will be no significant impact on the chemical status. Verification of compliance of potentially caused additional emissions into groundwater at certain locations and due to possible spills of hazardous substances is checked in environmental impact assessments at lower planning levels or in procedures for obtaining environmental permits.

INECP also foresees the promotion of biogas production. Biogas production generates digestate (digested sludge), which can be used as fertilizer. Emissions from biogas plants and improper use of digestate can directly lead to nitrate pollution of groundwater. The impact of specific biogas plant locations is verified as part of the environmental impact assessment at the lower planning level (in the case of an intervention requiring an environmental impact assessment) or as part of the waste treatment permit.

INECP predicts an increase in the area of solar energy receivers. Energy-efficient use of solar panels also requires periodic cleaning. The treatment process creates wastewater that can be contaminated with detergent residues (e.g., surfactants) and substances removed from the panel surface during the treatment process, especially dust deposits that can be contaminated with various pollutants that are part of the dust deposits). This type of wastewater must be discharged into a public sewer that ends with a municipal wastewater treatment plant. If this is not possible, before releasing it into the environment, the properties of this type of wastewater from panel cleaning must be checked, and based on the results of the analysis, the method of dealing with it must be determined. If it is taken into account the measures to mitigate the impact of installing solar energy receivers on the environment, the impact on this environmental specific objective is insignificant.

- Effects on the quantitative status of groundwater

The construction of the RHPP can affect the level of groundwater due to changed hydro-morphological conditions in the river (accumulation, change in water level) and due to changes in the passage of groundwater into the river and vice versa. Specific impacts depend largely on local conditions and how groundwater is brought to the site. In addition to changes in the level of groundwater, there may also be changes in the direction and speed of groundwater flow.

An increase in the level of groundwater can occur due to an increase in the water level of the river and the release of water from drainage channels and pipelines into the groundwater. A lowering of the groundwater level can occur due to the sealing of the reservoir as a result of turbidity and due to sealing curtains on the banks. Some experiences and studies show that hydro-morphological changes in watercourses (especially the lowering of the water level as a result of the deepening of the bed downstream of the dam) as a result of hydropower and other interventions can significantly contribute to the lowering of the groundwater level if no appropriate measures are in place.

The impacts on groundwater are permanent, direct and regional and decrease with the distance from the watercourse and with the distance from the dam downstream. Indirect impacts can also occur, as fluctuations in groundwater can affect the water levels of other watercourses and fluctuations in the level of groundwater in deep geothermal aquifers. There may also be indirect impacts on the chemical status of groundwater (raising groundwater may result in increased sensitivity to contaminants). The potential lowering of the groundwater level due to the lowering of the river's water level represents an indirect impact, which together with other pressures (climatic changes, groundwater abstraction, hydro-morphological changes of watercourses due to other arrangements) can threaten the use of water for other purposes (cumulative impacts). Fluctuations in groundwater levels can have a significant impact on terrestrial habitats that are sensitive to such fluctuations (indirect effects). Similar impacts on a smaller scale are possible due to the operation of small power plants in the absence of preventive and mitigation measures.

The construction of large HPPs implies interventions that require an environmental impact assessment in accordance with the Regulation. The impacts of specific HPP locations on groundwater will therefore be assessed at a lower planning level. it is recommended, mitigation measures be taken into account in HPP planning to prevent changes in the level, direction and velocity of groundwater flow, as well as to prevent deterioration of the chemical status of groundwater.

INECP foresees the continuation or further promoting the use of geothermal energy in the public and other service sectors. There are two ways of use, with heat pumps and direct use. Using geothermal energy with heat pumps is done using shallow sources in the temperature range below 25 °C. Direct use of geothermal energy takes place by extracting hot geothermal water from deeper aquifers.

The use of geothermal energy with heat pumps does not affect the quantitative state of aquifers when the energy is obtained indirectly from the ground (HPP underground water; heat transfer through heat exchangers from the ground to the water medium). In the case of groundwater capture, there may be a change in the quantitative status of groundwater, so it is necessary to consider mitigation measures (mandatory reinjection) or prohibition or restrictions due to the priority use of drinking water resources.

Direct use of thermal water from deep geothermal sources can lead to disruption of hydrodynamic balance and reduction of pressure and level of geothermal water in aquifers (direct, remote impacts) in case of excessive and uneconomical exploitation. In these cases, energy-depleted geothermal water is not released back into the aquifer (reinjection), but into the environment (watercourse). Exploitation of geothermal energy in this way can also indirectly affect the status of watercourses (thermal pollution, introduction of salts and pollutants as a result of the natural content of these substances in geothermal water), if such wastewater is discharged untreated and uncooled into the environment. The existing use of ground water from geothermal sources is not sustainable (mostly the water does not return to the aquifer), because indicative measurements show a statistically significant trend of the decline of ground water into geothermal water. Uncertainty about the actual state of aquifers is a major problem due to the lack of continuous monitoring. Potentially additional uneconomic use of geothermal water could cumulatively contribute to further deterioration if no mitigation measures are put in place.

Impacts on deep geothermal aquifers due to irrational use of groundwater can be transboundary (aquifers are shared with BiH, Croatia and Hungary). Given the uncertainties surrounding the actual quantitative status of deep geothermal sources and the estimated risks, the impact of the implementation of INECP on the quantitative status of deep geothermal sources is insignificant with the implementation of the appropriate prevention and mitigation measures.

INECP predicts an increase in the volume of production in the industry, which can increase the amount of water withdrawal from underground water for technological purposes. This can affect the quantitative status of groundwater. Taking into account the conclusions of BAT on efficient use of water and the conditions and restrictions from the given water permits and concessions, as well as impact assessments at lower planning levels, the expected impact of the increase in industrial production on the quantitative groundwater status will be insignificant.

Measures in place aimed at improving wastewater treatment and discharge as well as measures aimed at improving waste management through the promotion of recycling and circularity are expected to have a positive contribution to the objective under examination.

Based on the above and as indicated in the table below, INECP may have negative impacts on the Environmental specific objective "Improved status or ecological potential of water bodies including surface water and groundwater" (overall rating – negative impact). However, the EIA and environmental and water permit requirements to be implemented at a later stage as well as the overall regulatory framework are expected to prevent and/or minimize potential negative impacts.

Table 5.12: Identification of the characteristics of significant impacts of the implementation of INECP on the environmental specific objective "Improved status or ecological potential of water bodies including surface water and groundwater".

Environmental Objective	**EO 04. Protection of surface & ground water (morphology, ecological status, quantity and quality)**	**Impact characterization**						
		Type	Impact risk (Probability)	Intensity	Magnitude	Reversibility	Duration	Cumulative ness / Synergy
Specific Objective	**SEO 04.1 Improved status or ecological potential of water bodies including surface water and groundwater**							
Impact assessment question	Are INECP interventions expected to protect the aquatic environment, including coasts, from pollution, or even improve the quality characteristics of surface and groundwater and the marine environment?							
Dimensions	**Reduction of GHG**	+	1	2	G-R	NR	2	1
	RES	+/-	1/2	2	G-R	NR	2	1
	Energy efficiency	-	1/2	2	G-R	NR	2	1
	Energy security	-	1/2	2	G-R	NR	2	1
	Internal energy market	-	1	2	G-R	NR	2	-
	Research, innovation and competitiveness	+	1	1	N/M	NR	2	1
Overall assessment	- Negative							

5.1.2.4.2 Environmental specific objective "Sustainable use of water"

Evaluation of the impact of INECP implementation

The potential impacts of RHPP on the status of groundwater may indirectly affect the use of groundwater provided based on the issued water permits or concessions (drinking water supply, use of geothermal water, use for technological purposes). The construction of large RHPPs implies interventions that require an environmental impact assessment. The impacts of individual MHPP locations will thus be verified as part of environmental impact assessments at lower hierarchical levels of planning.

The implementation of INECP without the implementation of adapted prevention and mitigation measures could affect the lowering of temperatures in shallow aquifers and thus the efficiency of water use by existing and future users. It is mandatory to obtain a water permit for water use and a permit for groundwater research at depths above 30 m. Mitigation measures have been proposed in relation to the establishment of records of all geothermal heat pumps, obligations to return water to the aquifer and guidelines for shallow geothermal drilling.

Due to the planned increase in the direct use of geothermal energy from deep aquifers, the implementation of INECP may have a negative impact on the quantitative status of deep geothermal sources and therefore on existing users of geothermal water for pool filling and heating in the absence of preventive and mitigation measures. Given the uncertainties about the actual quantitative status of deep geothermal aquifers and the assessed risks, the impact of the application of the INECP on the use of water for bathing or heating is assessed as negligible with the implementation of mitigation measures such as the introduction of continuous monitoring of the quantitative status of geothermal sources before further granting concessions for the use of water from geothermal sources and the introduction of reinjection, where technically feasible, for existing and future users of geothermal water.

The implementation of INECP may affect the use of surface water for technological purposes if new natural gas power plants are planned to collect surface water for cooling in the vicinity of other abstractions for technological purposes where the required water temperature is determined. The use of surface waters for technological and other purposes can also be affected by the construction of HPPs due to potential changes in the temperature of surface waters as a result of accumulation and due to the capture of water from the bed in the case of derivation HPPs. MHPP and HPP are interventions of such a nature and scale that they require an environmental impact assessment at which stage prevention and mitigation measures will be proposed for the reduction of potential negative impacts.

INECP anticipates an increase in the volume of production in industry, which may increase the amount of water withdrawal from surface waters or water for technological purposes. This may affect existing water users. Considering the BAT conclusions on efficient water use and the conditions and restrictions from the given water permits and concessions, as well as impact assessments at lower levels of planning and environmental permitting procedures, the impact of increased production on water use due to increased industrial production is expected to be negligible.

Additionally, measures in place aimed at improving wastewater treatment and discharge as well as measures aimed at improving waste management through the promotion of recycling and circularity are expected to have a positive contribution to the objective under examination.

Finally, the impacts of the implementation of INECP on the use of drinking water are defined in more detail in the environmental objective “Protection of human health”.

The following issues were considered:

1 – deterioration or impossibility of other types of water use as a result of HPP operation (drinking water, navigability, rheophilic fish fishing)

2 - Impact on the efficiency of using water from shallow geothermal sources due to more intensive installation of heat pumps

3 - Impact on other users of geothermal energy from deep geothermal aquifers due to the planned increase in the production of this energy source

4 - Impact on other surface water users for technological purposes due to the thermal loads of watercourses during the construction of a new natural gas PPE.

Based on the above and as indicated in the table below, it can be concluded that while the majority of interventions have no negative impact, some infrastructure projects may lead to negative impacts. These will be assessed in detail in subsequent EIAs and are expected to be negligible once further mitigated with the implementation of appropriate measures. Overall the impact is assessed as mixed.

Table 5.13: Identification of the characteristics of the identified significant impacts of the implementation of INECP on the environmental specific objective "Sustainable use of water"

Environmental Objective	EO 04. Protection of surface & ground water (morphology, ecological status, quantity and quality)	Impact characterization						
		Type	Impact risk (Probability)	Intensity	Magnitude	Reversibility	Duration	Cumulative ness / Synergy
Specific Objective	SEO 04.2 Sustainable use of water							
Impact assessment question	Do INECP interventions support the rational use of water?							
Dimensions	Reduction of GHG	+	1	1	G-R	NR	2	1
	RES	+/-	1	1	G-R	NR	2	1
	Energy efficiency	-	1	1	G-R	NR	2	1
	Energy security	-	1	1	G-R	NR	2	1
	Internal energy market	-	1	1	G-R	NR	2	-
	Research, innovation and competitiveness	+	1	1	N/M	NR	2	1
Overall assessment	+/- Mixed							

5.1.2.4.3 Environmental specific objective "Protection and sustainable use of agricultural and forest land"

Evaluation of the impact of the implementation of INECP

INECP envisages various interventions that require space and can potentially have a permanent, direct and cumulative impact on agricultural and forest land (interventions such as transport infrastructure, natural gas power plants, wind, solar and hydropower plants, biogas plants, wood biomass power plants, electricity transmission infrastructure). These interventions can reduce the size of agricultural and forest land. The location of infrastructural works will be verified at the level of spatial planning with regard to the impact on the extent of agricultural and forest land. When planning the locations and specifics of these projects/facilities, one should consider the appropriate protection regimes and restrictions and the general guidelines of the Ministry responsible for agriculture and forestry for the preparation of spatial planning documents. When intervening in the area, areas for agriculture and food production should be avoided, and if such interventions cannot be avoided, interventions should be directed to the agricultural land with low productivity, considering the strategic importance of food production. Namely, mass use of high-quality agricultural land for the installation of solar panels must not be allowed. One measure could be that when issuing energy permits, introduce a special step for checking the quality, purpose, potential of land, but also biodiversity in the specific area for solar power plants.

INECP foresees the promotion of the use of solar energy for the production of electricity, whereby most solar power plants are installed on buildings. A smaller share of solar power plants are expected to be free-standing, located on degraded land areas or industrial locations. In order to achieve a rational use of land, the installation of solar power plants on roofs, where technically feasible, should be a priority. Freestanding solar power plants should be located in degraded and industrial areas, and not near forests, archaeological sites, land of high productivity, and priority habitats. In cases there are near by streams then a hydraulic and hydrological study needs to be conducted and in cases where in the vicinity there are Natura sites, then a Special Ecological Assessment study will need to be conducted.

INECP foresees the use of wood and plant biomass for energy purposes, namely: promoting biomethane production in the energy supply of households and industry as a substitute for natural gas and for use in long-distance transport, promoting the use of wood biomass for heating and promoting the use of biofuels. This may affect the sustainable use of agricultural and forest land in the medium term (as long as such use of agricultural and woody biomass is carried out). INECP already states important principle limitations for the use of biomass for energy purposes:

- Biomass sources follow the ethical principle that biomass is primarily used for human consumption and for feeding domestic animals. Biogas should be produced only from residues, waste and surpluses that cannot be used for other purposes;

- The volume of energy use of wood biomass must not endanger other forest functions. Due to the sustainable use of forests, the use of wood biomass must always be subordinated to the use of wood for the production of wood products, so that for energy use, as a rule, residues from the production of wood products are used.

INECP takes into account the sources of agricultural biomass from the fields (the so-called crop residues). INECP also foresees the theoretical exploitation of the technically usable potential of livestock manure, which least interferes with primary agricultural production. Impacts on the sustainable use of agricultural land due to biogas production are therefore not expected. In the energy use of biomass for biogas production, in addition to livestock manure, the use of biodegradable, municipal and industrial waste, sludge from wastewater treatment plants, digested sludge from anaerobic treatment and other biodegradable waste should be foreseen and encouraged.

INECP foresees an increase in the share of RES by increasing the use of biofuels in transport.

Depending on the source of production, biofuels fall into several groups:

- First generation biofuels refer to those biofuels that are produced from sugar, starch, vegetable oils or animal fats. In the process of processing, crops known from the food industry are used, such as wheat, corn, sugar beet, sugar cane, soy. According to the new Directive on RES (2018/2001/EU), the application of first-generation biofuels is limited, or it is not considered when calculating the share of RES in transport;
- Second generation biofuels are obtained by processing lignocellulose contained in plant residues such as wood biomass, straw, grass (unlike first generation biofuels, they are not obtained from seed residues);
- In the third generation of biofuels, oils are extracted from algae that are processed into energy comparable to: gasoline, diesel, aviation fuels, etc.

Given that INECP envisages the promotion of the use of 2nd and 3rd generation biofuels, which do not involve interventions on existing or new agricultural land, significant impacts on sustainable land use due to the promotion of biofuels in traffic are unlikely.

There will be no cross-border and synergistic effects of INECP on sustainable land use.

It should also be noted that that specific PM are proposed for sustainable forest management (forest land remaining forest land) as part of the INECP, which is expected to have positive impacts on the specific environmental objective.

The following issues were considered:

1 - Reduction of agricultural land and forests due to the implementation of infrastructural measures foreseen by INECP

2 - Impacts on the use of agricultural land for food production and forests for the production of wood due to the planned energy use of wood and other plant biomass

Based on the above and as indicated in the table below, the proposed interventions of INECP strategy is expected to have overall mixed impact (low positive and negative impacts) with the implementation of the existing regulatory framework and accompanying prevention and mitigation measures.

Table 5.14: Identification of the characteristics of significant impacts of the implementation of INECP on the environmental specific objective "Protection and sustainable use of agricultural and forest land"

Environmental Objective	EO 04. Protection of surface & ground water (morphology, ecological status, quantity and quality)	Impact characterization						
		Type	Impact risk (Probability)	Intensity	Magnitude	Reversibility	Duration	Cumulativeness / Synergy
Specific Objective	SEO 04.3 Protection and sustainable use of agricultural and forest land							
Impact assessment question	Will the interventions included in the INECP directly or indirectly lead to the preservation of the quantity and quality of useful lands and their rational land use, and will they directly or indirectly lead to the reduction of pollution and land degradation?							
Dimensions	Reduction of GHG	+	2	1	N/M	NR	2	1
	RES	0/-	2	1	G-R	NR	2	1
	Energy efficiency	0/-	2	1	G-R	NR	2	1
	Energy security	0/-	2	1	G-R	NR	2	1
	Internal energy market	-	1	1	G-R	NR	2	-
	Research, innovation and competitiveness	+	1	1	N/M	NR	2	1
Overall assessment	+/- Mixed							

5.1.2.5 Environmental Objective “Protection, of biodiversity and geodiversity”

5.1.2.5.1 Environmental specific objective "Preservation of biodiversity "

Description and assessment of the impact on biodiversity

Large HPP

The construction of a hydroelectric power plant can cause significant changes in the hydrology and morphology of watercourses and, therefore, changes in the river ecosystem.

The construction of a dam and the transformation and improvement of the shores of the reservoir can affect the species and their habitats located on the construction site. The changes that occur later, during the establishment of water accumulation, are due to the slowing down of the water flow as a factor that decisively affects the shape of the bed, the arrangement of the substrate in the bed, the temperature stratification of the water column, oxygen in the water, the distribution and availability of food and, consequently, the distribution of organisms in the water.

In part of the watercourse, a smaller part of the structure and functions of the flowing water ecosystem is preserved, and a part of the structure and function of the stagnant water ecosystem is established. There is no major shift in the direction of the lenticular ecosystem due to frequent and fairly large fluctuations in the water level. Along the coast of the reservoir, an occasionally flooded zone is established, which does not restore all the functions of the lakeshore and in which the level of biodiversity is relatively low. In the reservoir, the values of physico-chemical parameters change depending on the watercourse, the structure and dynamics of primary producers change, the association of fish and aquatic invertebrates in the watercourse changes.

The main impacts of the construction of hydroelectric power plants are:

- Interrupted longitudinal and transverse connection of watercourses leads to the fragmentation of populations of some aquatic invertebrates and heophilic fish species, which can lead to the local extinction of certain species;
- Disrupted transport of sediment and nutrients. The slow flow of water does not float river sediments of larger diameters, which form important structures in the habitat of benthic invertebrates and fish spawning grounds. As a result, the amounts of river sediment (sand, gravel), which is the spawning substrate for lithophilic hatcheries, are also reduced in the downstream parts due to reduced sediment flooding. It can also increase the flow of nutrients and sediments that accumulate in the reservoir. As a result, the amount (e.g., of macrophytes) increases, which implies expensive maintenance (e.g., removal of overgrowth) and significant changes in the entire artificial aquatic ecosystem (e.g., increase of herbivore populations);
- The silting of the reservoir fills the interspaces at the bottom of the river, significantly impoverishes the interspace fauna and changes the degree of connection between the

watercourse and the groundwater. In the long run, siltation can lead to a decline in groundwater. Habitat types related to correspondingly high groundwater levels (forests in the plains, swamps) can become threatened;

- Reduced microhabitat heterogeneity is a consequence of sediment deposition of smaller diameters in the reservoir, which unifies the substrate in the reservoir in the long term. The mosaic of microhabitats then changes into one predominant type of microhabitat;
- Changes in the riverbed downstream. Downstream of the high barrier, the trough deepens. Depending on the way of managing small-diameter deposits (silt) in the reservoir, significantly increased flooding may occur, which can cause its deposition in the downstream bed. Inertia spaces can also be blurred downstream leading to potential negative impact on the river habitat;
- The water regime and the values of the physical and chemical parameters of the water may change. Fluctuations in water levels no longer follow natural dynamics but are the result of managing the amount of water for the purpose of producing electricity. In the reservoir, the water column is stratified by temperature. When the upper layers are overheated in summer, cold water remains at the bottom. It is dominated by hypo (an) toxic states;
- The spread of foreign species of aquatic organisms and the interbreeding of species for which the anthropogenically altered aquatic environment provides favourable conditions for development and reproduction.

The magnitude of the impact depends on the type of hydropower plant, the size of the dam and reservoir, with larger dams and larger reservoirs having a greater impact. The specific location of the HPP is important. Due to the cumulative effects, the impact of the HPP chain is greater than the impact of an individual HPP.

According to the experience gained during the construction of existing HPPs, a negative impact on most rheophilic fish species may be expected. For example, brook trout are disappearing in some reservoirs. In other reservoirs, a gradual decline of populations was observed, e.g., chub, eel, perch, etc. Spawning grounds suitable for phytophilic spawning grounds are formed in the reservoir, lithophilic spawning grounds are destroyed and remain only in the upper reaches of watercourses or in tributaries.

A negative impact is also expected on aquatic invertebrates of flowing waters, aquatic macrophytes, species, habitats related to watercourses, interstitial fauna, terrestrial habitat types destroyed by the construction and operation of HPP.

The construction of a dam on a river can have significant consequences for fish populations: it can prevent or hinder fish migration and change the quality, quantity and availability of microhabitats. Although in practice these two factors are difficult to distinguish, it is estimated that changes in habitats can be attributed to about half of all local fish extinctions, while impassability is responsible for about 20 % of all local extinctions.

The size of the impact increases with the number of planned hydropower plants.

Transboundary impacts of RHPP Bistrica and RHPP Đerdap 3 were identified as insignificant due to the implementation of mitigation measures. Considering the wide range of established mitigation measures and assessments at lower assessment levels, the impacts of the implementation of interventions from the INECP will be insignificant due to the mitigation measures.

Small HPP

Small HPPs have a similar impact on the biodiversity of watercourses as large HPPs, but the extent of the impact may be smaller due to the smaller size of the reservoir. In the case of derivation MHPP, the provision of environmentally friendly flow is particularly sensitive. Since several small hydropower plants can be installed on a smaller watercourse that do not have common management, such a chain of MHPPs has a greater cumulative impact on biodiversity than one large hydropower plant due to broken continuity.

An increase in electricity production in the form of small hydropower plants is environmentally acceptable, with the implementation of appropriate prevention and mitigation measures. Considering the wide range of established mitigation measures and assessments at lower assessment levels, the impacts of the implementation of projects from this INECP is expected to be negligible.

Wind power plants

Wind farms cause two types of impacts:

1. A direct negative impact during the construction of the wind farm and associated road infrastructure and transmission network is the destruction of habitats and habitat types. Impacts on air and soil pollution, increase in noise and vibration intensity as a result of the operation of construction machines are of a short-term nature. In addition to these, there are other impacts that depend on each specific location where the wind farm is built, such as the possible impact on immovable cultural assets, but they do not have a significant strategic spatial impact.

2. During the operation of the wind power plant, the negative impacts are as follows:

- impact on ornitofauna (birds) and chiropterofauna, (bats),
- influence on increasing the intensity of noise and vibrations,
- effect of flickering shadows,
- impact on the landscape,
- impact in case of accidental situations.

The impact of WPP on birds and bats is a dominant influence and is manifested through increased mortality of birds due to collisions with rotary propellers and especially bats due to barotrauma as a result of flying near rotary propellers. These impacts can also be considered as transboundary impacts. Mortality can also increase due to collisions with elements of the VE transmission network if it is done above ground. Wind farms (wind power plants with a large number of wind turbines), as barriers in space, can have an impact on changes in the behaviour of migratory species, possibly reducing nesting performance. In addition to birds and bats, large carnivores (wolf, lynx, brown bear), which need unfragmented forest areas for their existence, are also potentially affected.

When it comes to the impact of noise, it can be stated that today's wind turbines generate a certain level of noise during operation, which is caused by the passage of the propeller through the air, while the noise from the generator itself is not of particular importance.

The placement of wind turbines can have an impact on the shading and glare of the wind turbines. Considering the dimensions of the wind turbines, which are extremely high, they can create a shadow in the surroundings. When they are in operation, unpleasant flickering of the shadows is possible in the morning and evening hours, due to the turning of the propellers of the wind turbine, which depends on the configuration of the terrain, the spatial arrangement in relation to the existing surrounding objects and the path of movement for each specific location.

Individual locations of WPP have not been assessed and therefore need to be assessed at the next planning levels by conducting individual environmental impact assessments in accordance with national Regulation.

Considering the wide range of established mitigation measures and assessments at lower assessment levels, the impacts of the implementation of projects from this INECP will be insignificant once appropriate prevention and mitigation measures are in place.

Solar power plants

Although the use of solar panels and solar power plants is positive from the aspect of reducing GHG emissions and preserving the environment, there are also negative aspects that can affect biodiversity:

1. Loss of habitat. The construction of solar plants involves the occupation of significant space, often in rural or natural areas, which can lead to the loss of habitat for many plant and animal species. The most direct impact of the construction of solar power plants is the removal of vegetation, and it is especially negative in cases when dealing with natural habitats inhabited by rare and endangered species.

2. Habitat fragmentation. Solar installations, especially large solar power plants, can lead to habitat fragmentation, which can make it difficult for animals to move and migrate. In this way, the possibility of finding suitable resources is reduced and it is difficult to reproduce and maintain the population. Habitat fragmentation can also lead to the isolation of populations, reducing genetic variability and increasing the risk of local species extinction.

3. Impact on birds and insects. Solar panels can attract birds and insects, which may perceive them as landing surfaces or as food sources. However, this can result in collisions with the panels, which can lead to injury or death in birds. Also, the installation of panels can disturb the natural habitat conditions for many insects that play an important role in plant pollination.

4. Destabilization of the ecosystem. As discussed, the construction of solar plants can isolate parts of natural habitats, creating barriers for animals and plants. This isolation can destabilize ecosystems, through the reduction of their species diversity, which leads to disruption of food chains and webs, natural regulation mechanisms and other ecosystem processes.

4. Changes in microclimatic conditions. Placing a large number of solar panels can change the microclimatic conditions in the environment, especially under the panels themselves. Solar power plants can occupy significant space and disrupt the light regime of the habitat, which can affect the processes of photosynthesis, growth and development of plants. Solar panels can absorb a large amount of solar energy and convert it into thermal energy, thereby increasing the local temperature. A large number of panels can prevent air movement and ventilation of the habitat, which can lead to the accumulation of pollutants and heat accumulation. All microclimatic changes can negatively affect the flora and fauna, eliminating species sensitive to them and favoring generalists, synanthropic, ruderal, and even invasive species that these conditions favor.

Before starting the construction of solar power plants, it is necessary to carry out a precise assessment of the impact on biodiversity. Solar power plants must not be planned in areas important for the preservation of biodiversity, but only on areas that have already been degraded and are not characterized by high-quality soil. Regardless, it is necessary to apply protective measures, which include setting up protective barriers and directing animals to safe corridors. In order to compensate for the negative impact on biodiversity, compensation programs can be applied, which include restoring habitats near solar power plants, planting indigenous plants that support biodiversity, and investing in nature protection programs. With the observance of all necessary measures, the effects of solar power plants on biodiversity will not be significant.

Construction of transportation infrastructure

During the construction of road and railway infrastructure, the habitat of species and habitat types that lie directly on the route of the built infrastructure is destroyed. It acts to fragment habitats and act as a barrier to migratory routes, increasing mortality (e.g., large carnivores, deer, deer, amphibians, bats, birds, insects) and causing changes in animal behavior. However, considering the wide range of established mitigation measures and assessments at lower assessment levels, the impacts of the implementation of projects from this INECP are expected to be insignificant once appropriate prevention and mitigation measures are in place.

Construction of the transmission and distribution network

During the construction of the transmission and distribution network, the following impacts on biodiversity are possible:

1. Physical destruction of the habitat. The construction of transmission and distribution networks can lead to the loss of natural habitats. However, habitat destruction is localized only to the pillar site and as such will not have a significant effect on biodiversity.

2. Collision with fauna. The transmission and distribution network can pose a risk to birds (APLIC 1994, Bevanger 1994, 1998, Janss 2000, IEEE Task Force 2004, Erickson et al. 2005, Rubolini et al. 2005, Bernardino et al. 2018), which may be killed in collisions. with cables and poles, which can have a significant impact on their populations.

The construction of the transmission and distribution network acts as an obstacle to habitat or migration routes, increasing mortality (of bats, birds) and causing changes in animal behavior.

Considering the wide range of established mitigation measures and assessments at lower assessment levels, the impacts of the implementation of projects from this INECP are expected to be insignificant once appropriate prevention and mitigation measures are in place.

Introduction of energy-saving lamps

Light pollution in mammals affects the day-night rhythm. At the level of an individual organism, there are disturbances in the regulation of body temperature, blood pressure, hormone secretion and other physiological processes. Among the more important disorders is reduced or interrupted secretion of melatonin, which increases the risk of cancer. In addition to physiological processes in organisms, it also changes the behaviour of animals and reduces the quality and extent of their habitats. It affects both diurnal and nocturnal animals:

- Change the day-night rhythm,
- Disturbs the balance between predator and prey,
- Disturbing animals on migratory routes (according to Rich and Longscore, 2006).

A significant number of species are particularly endangered: 30 % of vertebrates and more than 60 % of invertebrates. Some nocturnal animals are attracted to light, some are repelled. Animals that orient themselves to celestial bodies are confused by light sources in their orientation. Those attracted to the light gather in large numbers near the lamps, where they are much more exposed to predators. Animals trapped in the beam of light are exhausted, running out of time for vital activities such as feeding, reproduction and migration.

INECP foresees the introduction of more energy-efficient lamps. This can increase the level of light pollution, but according to the mitigation measures, the effects are insignificant.

Impact of climate change on biodiversity

In a two-way process, climate change is one of the main drivers of biodiversity loss and destruction of ecosystems undermines the ability of nature to regulate GHG emissions and protect against extreme weather, fiercer storms, heat waves, wildfires etc. It is therefore worth noting that policy measures of the INECP aiming at mitigating the impact of climate change, particularly those targeting GHG emissions reduction can be considered to indirectly positively impact the specific environmental objective under examination under this section.

The following issues were considered:

1 - Deterioration of the state of preservation of biodiversity due to the construction of hydropower plants

2 - Deterioration of the status of biodiversity conservation due to the construction of small hydropower plants

3 - impact on biodiversity conservation due to the construction of wind farms

4- Impact on biodiversity conservation due to the installation of solar panels

5 - impact on f biodiversity conservation due to the construction of railway and road infrastructure

5 - impact on biodiversity conservation status due to the construction of the transmission and distribution network

6 – impact on biodiversity conservation status due to increased light pollution

7 – impact on biodiversity from measures contributing to climate change mitigation

Based on the above and as indicated in the table below, it can be concluded the overall impact on the environmental specific objective "Preservation of biodiversity " is Mixed +/- with the implementation of prevention and mitigation measures.

Table 5.15: Identification of the characteristics of the significant impacts of the implementation of INECP on the environmental specific objective "Preservation of biodiversity "

Environmental Objective	EO 05. Protection of biodiversity and geodiversity	Impact characterization						
		Type	Impact risk (Probability)	Intensity	Magnitude	Reversibility	Duration	Cumulative ness / Synergy
Specific Objective	SEO 05.1 Preservation of biodiversity							
Impact assessment question	Are infrastructure and/or activities of INECP expected to lead a loss of biodiversity and geodiversity directly or indirectly?							
Dimensions	Reduction of GHG	+	2	1	G-N/M	NR	2	1
	RES	-	2	1	G-N/M	NR	2	1
	Energy efficiency	0/-	2	1	G-R	NR	2	1
	Energy security	-	1	1	G-N/M	NR	2	1
	Internal energy market	-	1	1	G-N/M	NR	2	1
	Research, innovation and competitiveness	+	1	1	G-R	NR	2	1
Overall assessment	+/- Mixed							

5.1.2.5.2 Environmental specific objective “Preservation of areas with nature protection status”

Evaluation of the impact of INECP implementation

Serbia is home to 471 natural sites, declared as protected areas, as well as 5 national parks, 18 nature parks, 21 landscapes of exceptional features, 70 nature reserves – strict and special, 315 natural monuments (botanical-dendrological, geomorphological, geological and hydrological) and 6 protected habitats. It is also home to 1,784 strictly protected wildlife species, and 860 protected wildlife species. Serbia is currently on its way to establishing the Natura 2000 network. During the last two and half years, 277 Potential sites of Community interest (pSCIs) and 85 Special Protection Areas (SPAs) have been identified. The amendments to the Rulebook on the Declaration and Protection of Strictly Protected and Protected Wildlife Species of Plants, Animals, and Fungi (The Official Gazette of the Republic of Serbia, No. 5/10, 47/11, 32/16, and 98/16), placed 1,784 species of wild algae, plants, animals, and fungi under strict protection and 860 species under protection. The total of 2,634 species are under protection (with 10 present in both lists under strict protection in the Autonomous Province of Vojvodina and under protection in Central Serbia). Over 50% of strictly protected species are on the lists of international EU conventions and directives, for the most part in the Bern Convention on the Conservation of European Wildlife and Natural Habitats (The Official Gazette of the Republic of Serbia – International Agreements, No. 102/07) and the Bonn Convention on the Conservation of Migratory Species of Wild Animals (The Official Gazette of the Republic of Serbia – International Agreements, No.102/07) and the European Birds Directive (79/409/EEC, 209/147/EC). The total surface area of the protected zones stands at 678.24 ha, making up 7.66% of the territory and putting Serbia among the European countries with a relatively small share of space under protection and natural sites in the overall state territory.

Mechanisms of impact of large HPPs, small HPPs, wind and solar plants, construction of transportation infrastructure, transmission and distribution networks and energy saving lamps that could impact areas with nature protection status are described in the chapter assessing the potential impacts on biodiversity.

Considering the wide range of established mitigation measures and the required lower assessment levels, the impacts of the implementation of projects from the INECP will be insignificant provided preventive and mitigation measures are in place. It is recommended particular attention be placed from early planning phases to avoid sensitive areas or institutionally protected areas of environmental interest.

Overall, given the existing legal and regulatory framework in place, the steps of the Republic of Serbia to increase the efficiency in preparation for the accession to the EU in the field of nature protection as well as lower level assessments that will examine the localities requiring additional attention with regards to potentially affected qualified species and habitat types, as well as

taking into account the precautionary principle, it can be concluded that INECP will have an insignificant impact on the environmental specific objective "Preservation of areas with nature protection status", and will have an overall low Mixed impact +/-.

Table 5.16: Identification of the characteristics of significant impacts of the implementation of INECP on the environmental specific objective "Preservation of areas with nature protection status "

Environmental Objective	EO 05. Protection of biodiversity and geodiversity	Impact characterization						
		Type	Impact risk (Probability)	Intensity	Magnitude	Reversibility	Duration	Cumulative ness / Synergy
Specific Objective	SEO 05.2 Preservation of areas with nature protection status							
Impact assessment question	Are infrastructure and/or activities of INCEP expected to lead to the degradation of areas with nature protection status?							
Dimensions	Reduction of GHG	+	1	1	G-R	NR	2	1
	RES	0/-	1	1	G-R	NR	2	1
	Energy efficiency	0/-	1	1	G-R	NR	2	1
	Energy security	0/-	1	1	G-R	NR	2	1
	Internal energy market	0/-	1	1	G-R	NR	2	1
	Research, innovation and competitiveness	+	1	1	N/M	NR	2	1
Overall assessment	+/- Mixed							

5.1.2.6 Environmental Objective "Protection of cultural and historical heritage"

5.1.2.6.1 Environmental specific objective "Preservation of the state of cultural heritage sites and archaeological remains"

Evaluation of the impact of INECP implementation

Impacts on cultural heritage from the implementation of INECP measures, can be assessed at four levels:

- Measures that, taking into account protection regimes, can influence the improvement of the state of cultural heritage sites;
- Measures that may interfere with the whole cultural heritage, but will not affect the protected values of each and the state of the whole will not change;
- Measures that will lead to the installation of new buildings in the area, which may disturb the cultural heritage units and affect the protected values of the units, and
- Measures that do not interfere with cultural heritage units but have consequences that may affect the condition of cultural heritage units.

Within the framework of policies and measures related to the dimension of energy efficiency, the implementation of the INECP energy renovation of buildings measure may indirectly lead to the improvement of the state of cultural heritage units, especially the construction and settlement heritage directly, but also indirectly the cultural landscape. Due to the protection of cultural heritage through the regulatory framework in place, the implementation of some energy renovation measures should be carefully approached - some measures might not be implemented or may only be implemented partially, and the renovation costs may be affected.

In the case of heritage buildings, the structure is often in poor condition - in these cases, the energy renovation of buildings would only make sense if the structure is strengthened at the same time, which would further increase the cost of renovation. For the restoration of cultural heritage buildings and other special groups of buildings this will need to be conducted in such a way so as to ensure the implementation of the measures in the shortest possible time and in-line with relevant laws and regulations. It may be necessary to prepare criteria for determining acceptable costs for energy renovation of these groups of buildings and provide access to the necessary financial resources.

Direct negative impacts that would result in deterioration or even destruction of cultural heritage units as a result of the implementation of INECP measures, taking into account the legislation, definitions in spatial acts and the requirements of cultural protection conditions, are not expected to occur. For cultural heritage entities, the consent of the Institute for the Protection of Cultural Monuments will need to be secured, and financial incentives from national or international sources may need to be accessed.

INECP foresees the implementation of measures that may interfere with cultural heritage units but will not affect the protected values of individual units. Such measures include the installation of heat pumps, energy saving measures for lighting, connection to the distribution network (e.g., gas pipeline, district heating). In these situations, with appropriate implementation of the intervention/measure, e.g., in the case of protecting the facade in the inner yard, there will be no negative impacts. The implementation of all measures where interventions will be carried out on the cultural heritage as a whole (regardless of whether the intervention affects protected values or not) must consider the legal regimes for the protection of the whole and the acquired conditions for the protection of culture.

The implementation of INECP measures, which provide for the installation/building of facilities in the area, such as wind farms, hydroelectric power plants, small hydroelectric power plants, thermal power plants and biogas plants, may affect the protected values of cultural heritage units, especially their visual perception due to communication and infrastructure connections. Visual perception is essential for the presentation and interpretation of cultural heritage, which is also key to its preservation. The heritage community can attribute to each cultural landscape the meanings on which the work of the local community is based, and large infrastructural interventions can interfere with the preservation of cultural identity. The prerequisite for the location of these facilities is the appropriate purposeful use of the space, which is defined by spatial acts. The enforcement of the legal and regulatory measures in place are key to the adequate protection of the said areas and measures should be in place to mitigate any adverse effects on visual perception.

In addition, during the implementation of measures/construction of facilities, the legal regimes for the protection of cultural heritage units and the acquired conditions for the protection of culture must be taken into account. In order to avoid potential increased pressures on the location of buildings and the implementation of projects and activities in the areas of cultural heritage units or even in the units themselves, protection regimes must be taken into account when planning. It is recommended INECP explicitly defines that projects should be located outside or far away from the units of cultural heritage. If this is not feasible, then variant solutions need to be defined which are then will be coordinated with the competent institution or competent Ministry.

In addition, INECP in the context of the scenario for solar systems, "to be installed to a lesser extent on all objects where it is economically justified and technically possible according to the needs", clearly states that the protection guidelines in the field of cultural heritage units have been taken into account.

Application of laws in the area of cultural heritage protection and respect for the regime of protection of cultural heritage entities in the implementation of all activities will contribute to prevent any negative impacts. Spatial planning is an additional instrument for the protection and management of cultural heritage and archaeological sites. The prerequisite for the location of any planned facilities is the appropriate use of space, which is defined by spatial acts, including the assessment of the impact of plans on cultural heritage taking into account the archaeological potential of the archaeological remains as a whole.

Protection measures will be determined by the competent Institute for the Protection of Cultural Monuments in the further planning and construction process.

In order to avoid possible increased pressures due to the implementation of INECP measures, which provide for the installation of buildings in the area, planning must take into account the regimes for the protection of archaeological heritage and archaeological remains. Interventions and activities in the area must be planned and implemented in such a way as to preserve the archaeological remains on the site. Clearly defining through the INECP that all planned interventions must be located outside the archaeological heritage units could further reinforce the prevention of relevant potential negative impacts. In the case of projects that may have a significant impact on the environment or for spatial planning of national importance, preliminary archaeological research should be carried out.

The implementation of INECP is not expected to have cross-border impacts.

The following issues were considered:

1 - Improvement of the condition of cultural heritage units due to the renovation of buildings

2 - Deterioration of the state of cultural heritage units due to direct influences on matter, the appearance of objects, obscuring views, destruction of spatial relationships, historical locations in space

3 - Indirect deterioration of the condition of cultural heritage units due to the implementation of measures whose impact is reflected in the cessation of use of cultural heritage objects.

Based on the above, including the existing regulatory framework, it is estimated that cultural heritage and archaeological sites are adequately protected. Negative impacts may occur with regards to visual perception depending on the selected location of infrastructure projects. The implementation of additional prevention or mitigation measures will minimize any such negative impacts from occurring. INECP dimensions are therefore not expected to have any significant negative impact on the specific environmental objective. The dimension involving renovations for energy efficiency purposes might potentially have indirect positive impacts. Overall, the impact is assessed as Mixed (+/-).

Table 5.17: Identification of the characteristics of significant impacts of the implementation of INECP on the environmental specific objective "Preservation of the state of cultural heritage sites and archaeological remains"

Environmental Objective	EO 06. Protection of cultural and historical heritage	Impact characterization						
		Type	Impact risk (Probability)	Intensity	Magnitude	Reversibility	Duration	Cumulativeness / Synergy
Specific Objective	SEO 06.1 Preservation of the state of cultural heritage sites and archaeological remains							
Impact assessment question	Are infrastructure and/or activities of the INCEP expected to directly or indirectly lead to degradation of monuments, historical objects and archaeologically protected?							
Dimensions	Reduction of GHG	0	-	-	-	-	-	-
	RES	0/-	1	1	G	NR	2	1
	Energy efficiency	+/-	2	2	G-R	NR	2	1
	Energy security	0/-	1	1	G	NR	2	1
	Internal energy market	0/-	1	1	G	NR	2	1
	Research, innovation and competitiveness	0	-	-	-	-	-	-
Overall assessment	+/- Mixed							

5.1.2.7 Environmental Objective "Protection of the landscape"

5.1.2.7.1 Environmental specific objective "Preservation of exceptional landscapes, areas of national recognition and recognisable and typological characteristics of the landscape"

Evaluation of the impact of the implementation of INECP

Impacts on the landscape refer to the implementation of measures that will involve physical intervention in the landscape, which will lead to a change in the properties of the landscape (landscape images, mosaics, traditional land use, symbolism, uniqueness, identity, etc.), the uniqueness of each type of landscape and the preservation of the diversity of the landscape at the state level. Despite the fact that part of the landscape is protected by nature protection regimes, there is no departmental and sectoral regulation that would prescribe and control the protection of landscapes and their characteristics and diversity in Serbia. As a result, with the implementation of INECP measures, there might be a risk of negative, permanent, cumulative and long-term impacts on the quality of the landscape. Infrastructural projects in the area should therefore be planned as a priority outside the areas of exceptional landscapes and in such a way the impacts of the implementation of projects and activities on the landscape are as acceptable as possible. The identification and implementation of spatial alternatives should be considered. In reducing the impact on the landscape, it is important to assess the impact of spatial plans on the landscape, which determine the suitability for the implementation of certain interventions in the space in a way that mitigates the impact on the landscape and preserves its typological and recognizable characteristics on the local and national level, on which further development is based the landscape and society.

The application of INECP measures might have an impact on the visual perception of the landscape - blurring of views, subordinate dominants and changes in spatial relationships, which may consequently affect the experience of the landscape. In addition, the implementation of the measures may have a negative impact on other features of the landscape, such as symbolic meaning, traditional land use and related landscape patterns. Measures involving the construction of infrastructure lines, roads, energy facilities (HPP, WPP, GSPP, biogas plants), the realization of which is foreseen by INECP, may lead to negative impacts on landscape.

Especially for larger infrastructure facilities (HPP, WPP, GSPP, GPP, biogas plants, RHPP and MHPP) the environmental impact assessment will need to consider impacts on the landscape and its development in each specific location. It should be emphasized that in the process of selecting the locations of these facilities, it is necessary to identify and consider several spatial alternatives, and take into account the limitations of all elements of the environment, it is necessary to gradually identify appropriate locations as well as the layout of the facilities and accompanying infrastructure (e.g., layout of internal wind farms and access roads) in the context of impact on the landscape.

Based on the above and in the table below, it can be concluded that INECP dimensions involving the development of infrastructure may negatively impact on the environmental specific objective "Preservation of exceptional landscapes, areas of national recognition and recognizable and typological characteristics of the landscape". While overall, the impact is evaluated as negative (-), EIAs required for the development of some of the interventions and responsible planning including early definition of alternative locations will contribute to minimizing potential negative impacts.

Table 5.18: Identification of the characteristics of the significant impacts of the implementation of INECP for the environmental specific objective "Preservation of exceptional landscapes, areas of national recognition and recognizable and typological characteristics of the landscape"

Environmental Objective	EO 07. Protection of the landscape	Impact characterization						
		Type	Impact risk (Probability)	Intensity	Magnitude	Reversibility	Duration	Cumulativeness / Synergy
Specific Objective	**SEO 07.1 Preservation of exceptional landscapes, areas of national recognition and recognizable and typological characteristics of landscapes**							
Impact assessment question	Will there be a change in the natural, cultural and aesthetic character of the landscape, areas of national recognition and typological characteristics of the landscape as a result of INECP interventions?							
Dimensions	Reduction of GHG	0	-	-	-	-	-	-
	RES	-	1	1	G-R	NR	2	1
	Energy efficiency	-	1	1	G-R	NR	2	1
	Energy security	-	1	1	G-R	NR	2	1
	Internal energy market	-	1	1	G-R	NR	2	1
	Research, innovation and competitiveness	0	-	-	-	-	-	-
Overall assessment	- Negative							

5.1.2.8 Environmental Objective “Stable Economic and Social Environment”

5.1.2.8.1 Environmental specific objective “Ensure economic and social stability”

Diversification of energy sources and fuel supply countries is the main objective of INECP for the dimension of energy security. More precisely, policies and measures will be initiated to strengthen the diversification of energy sources in order to prevent dependence on only one fuel or only one country. The achieved diversification will increase the competitiveness between fuels and suppliers from third countries which is expected to lead to lower energy prices, increased security of supply and enhanced protection of energy supply in the event of an energy crisis at regional level.

It is evident that optimal use of domestic energy sources should be ensured in order to increase energy security. Identification of existing potential and the most cost-effective use of domestic energy sources is an essential objective within INECP. Emphasis will be placed on the use of RES, both for the production of electricity and for direct use in end use, which is expected to significantly contribute to energy security.

Strengthening the geopolitical role of the Republic of Serbia represents another vital objective. Therefore, it is urgent to complete the existing interconnections and design new international interconnections with pipelines from neighbouring countries. In the future, these actions will also contribute to the diversification of energy sources and supply routes from third countries. Several cross-border/international natural gas transport projects will be promoted, fostering the diversification of energy sources and, in conjunction with the improvement of natural gas storage projects, ensuring adequacy in case of lack of natural gas.

Stabilizing the rate of energy dependence is another important goal within INECP. Accordingly, energy dependence should not exceed the level of 38 % in 2030.

An additional objective is to ensure the necessary electricity system adequacy in order to reach a minimum level of reliability to cover the demand for electricity, in connection with the decision to reduce electricity production in lignite plants. To achieve this objective, it will be necessary to adopt mechanisms to strengthen the system with additional capacity for electricity production or by promoting a demand response scheme.

The impact of the implementation of the INECP on economic stability also depends on the relationship between the additional borrowing needs to secure the necessary investments and the macroeconomic effects of the implementation of the INECP. According to the analysis of the macroeconomic and other effects of INECP, these are expected to be mostly positive; additional investment needs of the general government sector (especially transport and transmission networks) and funds for subsidies for a just transition to a low-carbon society are expected to be provided within the framework of increasing public income and existing financial instruments (support schemes and funds) .

The positive macroeconomic effects of INECP are expected to be mainly linked to the reduction of consumption of energy inputs in the economy and energy in households. Incomes of companies and households are likely to increase, along with total savings, which should have a positive effect on gross investments. The ratio of exports to imports is also likely to also increase due to lower imports of fossil fuels.

Public investment will be needed mainly in the areas of transport (railway), electricity distribution and local energy supply, and less in the areas of new supply and electricity transmission. It is expected that by 2030, around 10 billion euros will be needed for these investments.

Additional funding could also be accessed through new EU financial instruments for the restructuring of the coal region.

Health and wellbeing are fundamentals of social stability. It is worth noting that the positive impacts of the INECP measures for reducing GHG emissions and more generally climate change mitigation are expected to have, by extension, a positive impact on population health. The improvement of energy security, the creation of additional employment, including for the implementation of planned INECP actions, as well as the expected positive economic impacts are all expected to contribute to the population’s wellbeing and sustainable growth. The proposed INECP measures to address and alleviate energy poverty are also expected to positively contribute to social stability.

Based on the above and in the table below, it can be concluded that all INECP dimensions will have an overall strong positive impact (++) on the environmental specific objective "Ensure economic and social stability".

Table 5.19: Identification of the characteristics of significant impacts of the implementation of INECP on the environmental specific objective "Ensure economic and social stability".

Environmental Objective	EO 08A Stable economic and social environment	Impact characterization						
		Type	Impact risk (Probability)	Intensity	Magnitude	Reversibility	Duration	Cumulative ness / Synergy
Specific Objective	SEO 08A.1 "Ensure economic and social stability"							
Impact assessment question	Will the interventions covered by INECP directly or indirectly contribute to economic and social stability as well as sustainable population growth?							
Dimensions	GHG emissions and reduction	++	2	2	N/M	NR	2	1
	RES	++	2	2	N/M	NR	2	1
	Energy efficiency	++	2	2	N/M	NR	2	1
	Energy security	++	2	2	N/M	NR	2	1
	Internal energy market	++	2	2	N/M	NR	2	1
	Research, innovation and competitiveness	+	1	1	N/M	NR	2	1
Overall assessment	++ Strongly positive							

5.1.2.9 Environmental Objective "Improving investments and institutions for climate change adaptation and mitigation“

5.1.2.9.1 Environmental specific objective " Increase of investments in energy infrastructure and environmental protection "

INECP will increase investments in the direction of the green transition with a view of protecting the environment. It will contribute to the implementation of multiple RES investments, investments in energy efficiency and security, will foster the development of the electricity transmission system network and its interconnections, smart networks and investments in transport. It will also boost investments in Research, Innovation and Competitiveness that can further contribute to environmental protection.

As indicated in the table below, it can be concluded that the proposed strategy will have a positive impact on the environmental specific objective "Increasing investments in energy infrastructure and facilities and environmental protection" (overall rating ++ strongly positive)

Table 5.20: Identification of the characteristics of significant impacts of the implementation of INECP on the environmental specific objective " Increase of investments in energy infrastructure and environmental protection "

Environmental Objective	EO 08B Improvement in investments and infrastructure for climate change adaptation and mitigation	Impact characterization						
		Type	Impact risk (Probability)	Intensity	Magnitude	Reversibility	Duration	Cumulative ness / Synergy
Specific Objective	SEO 08B.1 " Increase of investments in energy infrastructure and environmental protection "							
Impact assessment question	Will INECP interventions contribute to the increase of investments in energy infrastructure and environmental protection							
Dimensions	GHG emissions and reduction	++	2	2	N/M	NR	2	1
	RES	++	2	2	N/M	NR	2	1
	Energy efficiency	++	2	2	N/M	NR	2	1
	Energy security	++	2	2	N/M	NR	2	1
	Internal energy market	+	2	2	N/M	NR	2	1
	Research, innovation and competitiveness	++	2	1	N/M	NR	2	1
Overall assessment	++ Strongly Positive							

5.1.2.9.2 Environmental specific objective " Improvement of institutions and personnel for environmental protection and climate change monitoring "

Evaluation of the impact of INECP implementation

The National Environmental Protection Program ("Official Gazette of the RS", No. 12/10) defines the strategic goals of the environmental protection policy, as well as specific goals for the protection of the environmental medium (air, water, soil) and the impacts of individual sectors on the environment (industry , energy, agriculture, mining, transport, etc.). Also, priority goals within the medium and sector were determined, and the necessary reforms were proposed, in order to achieve all the changes needed to achieve the set goals. The proposed reforms include reforms of regulatory instruments, economic instruments, monitoring systems and information systems, financing systems in the field of environmental protection, institutional issues and requirements related to infrastructure in the field of environmental protection. This document is comprehensive and formed the basis for other strategies that were adopted.

Accordingly, INECP provides important measures to mitigate climate change in the Republic of Serbia and create technical assumptions for the use of renewable energy sources and the reduction of GHG emissions in order to improve the state and system of environmental protection in all energy related areas. The implementation of INECP requires significant financial investments, but measures to improve and strengthen institutions, which imply institutional reform, development of legislation, enforcement of regulations at all levels, education and development of public awareness in the field of the environment, including organizational adaptation and systemic strengthening of professional and institutional capacities at the national, regional and local level are equally important.

Based on the above and as indicated in the table below, it can be concluded that INECP will have an overall positive impact (+) on the environmental specific objective "Improvement of institutions and personnel for environmental protection and climate change monitoring" .

Table 5.21: Identification of the characteristics of significant impacts of the implementation of INECP on the environmental specific objective "Improvement of institutions and personnel for environmental protection and monitoring of climate change"

Specific Objective	**SEO 08B.2 "Improvement of institutions and personnel for environmental protection and monitoring of climate change"**							
Impact assessment question	Is it expected that the institutions and personnel in the field of environmental protection and climate change monitoring will be improved as a result of INECP interventions?							
Dimensions	**GHG emissions and reduction**	++	2	2	N/M	NR	2	1
	RES	++	2	2	N/M	NR	2	1
	Energy efficiency	++	2	2	N/M	NR	2	1
	Energy security	+	1	2	N/M	NR	2	1
	Internal energy market	+	1	2	N/M	NR	2	1
	Research, innovation and competitiveness	++	2	2	N/M	NR	2	1
Overall assessment	++ Strong Positive							

5.1.2.9.3 Environmental specific objective Improvement of research, innovation and competitive employment "

The new cabinet of the Government of the Republic of Serbia will have a new ministry for the 21st century, namely the Ministry of Science, Technological Development and Innovation, which ensures the necessary condition and creates realistic conditions for the implementation of INECP measures.

In order to encourage companies to transition to a low-carbon circular economy efficiently and competitively, the INECP proposes significant support measures and one of the dimensions is specifically dedicated to research, innovation and competitiveness.

Based on the above and as indicated in the table below, it can be concluded that INECP scenarios will have an overall strong positive (++) impact on the environmental specific objective "Improvement of research, innovation and competitive employment".

Table 5.22: Identification of the characteristics of significant impacts of the implementation of INECP on the environmental specific objective " Improvement of research, innovation and competitive employment "

Environmental Objective	EO 08B Improvement in investments and infrastructure for climate change adaptation and mitigation	Impact characterization						
		Type	Impact risk (Probability)	Intensity	Magnitude	Reversibility	Duration	Cumulative ness / Synergy
Specific Objective	**SEO 08B.3 " Improvement of research, innovation and competitive employment "**							
Impact assessment question	Will INECP interventions improve research, innovation and lead to competitive employment growth?							
Dimensions	GHG emissions and reduction	+	2	2	N/M	NR	2	1
	RES	+	2	2	N/M	NR	2	1
	Energy efficiency	+	2	2	N/M	NR	2	1
	Energy security	+	2	2	N/M	NR	2	1
	Internal energy market	+	2	2	N/M	NR	2	1
	Research, innovation and competitiveness	++	3	2	N/M	NR	2	1
Overall assessment	++ Strong Positive							

5.1.2.10 Cross border impacts

As a signatory to the ESPOO Convention and Kiev Protocol, the Republic of Serbia has bound itself to inform other countries about proposed projects which may have transboundary impacts. In the Espoo Convention Environmental Impact Assessment, the transboundary impact is defined as “any impact not exclusively of a global nature, within an area under the jurisdiction of a Party caused by a proposed activity the physical origin of which is situated wholly or partly within the area under the jurisdiction of another party”. The Espoo Convention requires that if the proposed activity is found to cause significant adverse transboundary impact, the Party, i.e. the Government of the Country undertaking the activity shall, for the purposes of ensuring adequate and effective intervention, notify any other party (other country) which it considers may be affected by the activity as early as possible and no later than when informing its own public about the proposed activity.

Some activities with a potential cross-border impact that are planned within the INECP include:

1. Impact on the environmental specific objective " Reduction of air emissions" - Based on the planned INECP measures that directly affect the emissions of pollutants in the air and the estimated emissions of substances in the air, it can be concluded that there are no measures planned that could, to a significant extent, cause potential pollution of the ambient air in neighbouring countries,. According to the proposed scenario, a new gas-fired power plant is planned for 2030, its location is unknown. Its installation near the border of neighbouring countries is, however, unlikely. In addition, the power plant uses natural gas, which is one of the cleanest fossil fuels in terms of the emission of substances in the air and consequently does not significantly affect the quality of the ambient air. As a result, its potential impact on neighbouring countries is even lower.

A direct, short-term cross-border impact can also occur due to the emission of substances in the air from traffic that takes place along the border of a neighbouring country or in border crossing areas in case of traffic congestion in that area.

According to the projections of the reduction of national emissions of individual pollutants, a continuation of the reduction of the long-range cross-border movement of pollutants and their disposal in neighbouring countries can be expected, and vice versa. This will also reduce the impact on the environment and human health. If the aforementioned measure is implemented, the construction of a new gas power plant, the potential cross-border impact will have to be assessed in the spatial planning phase, and later during the environmental impact assessment phase.

2. Impact on the environmental specific objective "Reduced noise and vibration pollution“ At the strategic level, it is estimated that a potential cross-border impact of the increased noise pollution is possible in the case of individual railway and road network development projects, which are located in the area of influence, i.e. in the immediate vicinity of neighbouring countries. The potential transboundary impact of individual projects is assessed in the context of the ESPOO Convention, i.e. in accordance with Article 6 of the Convention on Transboundary Impacts on the Environment.

Placing wind farms near settlements in neighbouring countries could have cross-border impacts. The following mitigation measure, which reduces the possibility of transboundary impacts due to the construction of wind farms, is recorded in the SEA report: Wind farms are not located in areas where noise (including low-frequency noise and infrasound) may have a negative impact on human health and well-being. Based on the mitigation measures mentioned above, it is estimated that the construction of wind farms will not have cross-border impacts on the health and well-being of residents of neighbouring countries.

3. Environmental specific objective "Prevention and management of natural and other disasters". INECP foresees measures that may affect flood areas which could have a cross-border impact due to the proximity of a neighbouring country. Among them is the construction of RHPP "BISTRICA", which could negatively affect flood safety. Since the basic requirement in planning is that the risk of flooding does not increase, it can be concluded that the situation can only be maintained or improved.

When the conceptual project of RHPP Danube "ĐERDAP 3" is completed, with the aim of obtaining environmental approval, the environmental impact assessment procedure will be initiated, within which a cross-border impact assessment will be carried out in accordance with the ESPOO Convention, i.e. in accordance with Article 6 of the Convention on transboundary impacts on the environment. Namely, the construction of RHPP Dunav "ĐERDAP 3" and RPP "BISTRICA" is acceptable only with obtaining environmental consent. Based on this, it is estimated that the implementation of INECP will have an insignificant impact on the risk of flooding of the Drina River in the Republic of Bosnia and Herzegovina and the Sava River in the Republic of Croatia.

4. Impact on the environmental specific objective " Improved status or ecological potential of bodies of water, including surface water and groundwater ": The RHPP project "BISTRICA" is still not in the environmental impact assessment process. It is estimated that the impacts of INECP on the state of surface waters will be insignificant, taking into account mitigation measures.

Increasing the use of geothermal energy could affect the state of deep thermal aquifers in Hungary and Croatia, as indicative measurements show a potential decline of groundwater into geothermal waters in the Danube basin. The following mitigation measures are envisaged to reduce the impact on the state of geothermal aquifers:

- For the long-term restoration of regional deep thermal aquifers, it is necessary to ensure that all consumers of thermal water optimize its collection to the smallest possible amount, ensure maximum cascading use of thermal energy and return spent thermal water back to the aquifer (reinjection) is possible. The introduction of the most advanced technologies of thermal water exploitation systems should be encouraged.

- It is proposed to establish a national monitoring system for selected inactive wells in Vojvodina and Mačva. The indicator of the effectiveness of the reinjection measure is the achievement or preventing the deterioration of the good quantitative status of the aquifer.

- Monitoring and management of thermal water extraction and the condition of deep aquifers should be coordinated with neighbouring countries (Hungary and Croatia).

It is estimated that the transboundary impacts of INECP on the state of geothermal aquifers will be insignificant, considering mitigation measures. The potential transboundary impact of individual projects is assessed in the context of the ESPOO Convention and PVO procedures at more detailed levels of planning.

5. Impact on the environmental specific objective "Preservation of biodiversity". The planned construction of RHPP Danube "ĐERDAP 3" and RHPP "BISTRICA" could negatively affect biological diversity in the Republic of Romania. As part of the CPVO procedure for the SPN for the HP Mokrice area, transboundary impacts on biodiversity were assessed as insignificant due to the implementation of mitigation measures. When the conceptual project of RHPP Danube "ĐERDAP 3" is completed, the environmental impact assessment procedure will be initiated, within which a cross-border impact assessment will be carried out in accordance with the ESPOO Convention, i.e. in accordance with Article 6 of the Convention on transboundary impacts on the environment. Namely, the construction of RHPP Danube "ĐERDAP 3" is acceptable only on condition of obtaining environmental approval.

6. Impact on the environmental specific objective "Preservation of areas with the status of nature protection.": The planned construction of RHPP Danube "ĐERDAP 3" could have a negative impact on preserved protected areas and natural values in the Republic of Romania. Within the CPVO procedure for the area of RHPP Danube "ĐERDAP 3", cross-border impacts on protected areas were assessed as insignificant due to the implementation of mitigation measures. When the Conceptual Project of RHPP Danube "ĐERDAP 3" is completed, in order to obtain environmental approval, the environmental impact assessment procedure will be initiated, within which a cross-border impact assessment will be carried out in accordance with the ESPOO convention.

Placing wind farms in the vicinity of nature conservation areas of neighbouring countries could have transboundary impacts due to remote effects, particularly on birds and bats. The following mitigation measure is recorded, which reduces the possibility of cross-border impacts due to the construction of wind farms: Wind farms are not installed in areas where they could have further impact on areas with the protection status of neighbouring countries.

Based on the mentioned mitigation measure, it is estimated that the construction of wind farms will not cause cross-border impacts on areas with nature protection status in neighbouring countries.

7. Impact on the environmental specific objective " Preservation of exceptional landscapes, areas of national recognition and recognizable and typological characteristics of the landscape ": The installation of wind farms near areas of outstanding landscapes of neighbouring countries could have transboundary impacts due to remote effects. The SEA report therefore contains a mitigation measure that reduces the possibility of transboundary impacts due to the construction of wind farms:

- Wind farms are not installed in areas where they could have a further impact on areas of outstanding landscape in neighbouring countries.

Based on the mitigation measure mentioned above, it is estimated that the construction of wind farms will not cause transboundary impacts on the landscape in neighbouring countries.

8. Impact on the environmental specific objective " Increase of investments in energy infrastructure and environmental protection ": Implementation of measures for the development of railways and the European energy network

The implementation of INECP envisages the modernization and extension of the existing railway infrastructure and its connection to production centres and ports, which will have a positive impact on the regional capacities for railway freight transport and will enable a greater share of railway freight traffic with related positive impacts on the environment, i.e. the reduction of GHG emissions.

The implementation of INECP envisages meeting the requirements for the European connection of the energy network, the Serbian distribution network that will not cause disruptions in neighbouring countries, i.e., a positive impact is foreseen.

INECP measures are prepared at a strategic level, and the detailed descriptions of projects and activities are not available at this stage. Considering the mitigation measures that will be undertaken, it is estimated that there will be no significant transboundary impacts. For plans that could have a significant impact on the environment in neighbouring countries, the process of cross-border environmental impact assessment should be carried out in the further stages of project documentation in accordance with the ESPOO Convention.

5.1.2.11 Cumulative impacts

In accordance with the Law on Strategic Assessment (Article 15), the strategic assessment should include an assessment of cumulative and synergistic effects. Significant effects can result from the interaction between a series of minor impacts of existing facilities and activities and various planned activities in the planned area. Cumulative effects occur when individual sectoral solutions do not have a significant impact, and several individual effects together can have a significant effect. Synergistic effects are the result of the interaction of individual influences that produce a total effect greater than the simple sum of the individual influences.

The evaluation of cumulativeness and synergy is indicated in the individual evaluation tables.

5.2 GUIDANCE AND MEASURES TO PREVENT, REDUCE AND OFFSET SIGNIFICANT IMPACT OF INECP ON THE ENVIRONMENT

Based on the results of a qualitative analysis of priority dimensions (thematic areas) in the areas of decarbonisation, energy efficiency, energy security, the internal energy market and the areas of research, innovation and competitiveness, there were extremely positive effects for the proposed scenario, but it is necessary to consider measures for an immediate response to possible negative impacts of the implementation of INECP .

The review of the plan determined that INECP is a strategic document that should set goals, policies and measures for the period until 2030 (with a view to 2040 and a vision until 2050) in five dimensions (thematic areas) of INECP. The planning solutions of this strategic document were formulated in accordance with the basic goals defined in the INECP, which relate to providing a framework for the policy of access to energy and climate change, to reduce GHG emissions and increase energy production from RES, to increase energy savings and energy security, for solutions in the field of infrastructure development with the aim of improving the internal energy market and creating conditions for increasing the competitiveness of the economy. Environmental guidelines aim to direct identified negative impacts on the environment to remain within acceptable limits, with the aim of preventing threats to the environment and human health. They also serve to maintain positive trends. Environmental guidelines enable the development and prevention of conflicts in landscape planning, in accordance with the achievement of sustainable development goals.

Based on the results of the multi-criteria evaluation of the planned policies and measures according to the basic WEM and WAM scenarios, it is necessary to apply general measures for the implementation of these measures, future negative factors. environmental impacts and elements of sustainable development were identified:

- The application of environmental legislation is an obligation, as well as the implementation of international obligations in the field decarbonisation;
- Mandatory implementation of measures to achieve environmental objectives in accordance with the regulations of the Law on Water ("Official Gazette of the RS", no. 30/10 and 93/12), which includes prevention of deterioration, environmental protection and environmental protection for all water bodies, in order to achieve a good status of surface and ground waters and protected areas;
- Give priority to create register of polluting substances for the energy and industry sectors with GHG emission balances;
- Ensure education and participation of the public in all phases of realization of energy projects; ensure the participation of local communities, on whose territories emission reduction measures are foreseen, in decision-making in all stages of the implementation of these measures;
- In relation to activities that are determined to have a significant adverse transboundary impact, the "Party" or the State shall undertake activities to ensure adequate and effective intervention by any other state activity (state) related to the other party (country). as soon as possible, and at the latest when he informs the public about that activity.

- Obligatory implementation of environmental quality monitoring in accordance with relevant legislation and the Environmental Monitoring Program defined in this SEA;
- Mandatory application of the environmental impact assessment guidelines defined in this SEA and to elaborate them in detail in the process of implementing specific technical solutions, i.e. when preparing an EIA of the project regarding fossil fuels, renewable energy sources, district heating, electricity transmission and distribution infrastructure, natural gas, coal infrastructure, energy efficiency measures in housing, construction, industry, traffic, as well as energy measures in the electricity generation sector and incentive measures related to renewable sources energy;
- Usage of biomass should be priority for food production in order to avoid competitiveness in energy production.

The basic guidelines / measures proposed for the prevention, reduction and offset of the effects on the various environmental parameters of the implementation of the INECP are described below.

5.2.1 Measures for biodiversity, flora, fauna and forests

To prevent and minimize the effects of the implementation of the INECP on Biodiversity, flora and fauna, the following are proposed:

- It is not allowed to completely stop the water flow during the construction phase of the hydroelectric power plant or during the use of water facilities;
- Hydro-technical facilities must be designed so as to ensure a minimum sustainable flow in accordance with Article 81 of the Water Law (Official Gazette of RS, No. 30/10), without endangering the survival and migration of fish and other aquatic organisms. Hydro biologically acceptable minimum flow should be determined in the manner prescribed in the Law on Water;
- During the construction of the water intake structure, it is mandatory to build fish "paths" that will ensure unhindered access to aquatic organisms in accordance with the law governing this area;
- Fish "paths" must be dimensioned and placed in such a way, in relation to the water catchment, that there is always water in it and in an amount that corresponds to the average minimum monthly flow, in order to enable free passage of water and ichthyofauna;
- In case the fish "paths" consist of a number of smaller bases, the height difference between them should not exceed 0.2 m;
- Turbulence of water through fish "paths" must be as low as possible so that young animal forms can migrate;
- The bottom of the fish "path" must be covered with a natural substrate. It is best to use the

substrate from the watercourse itself, that is, the part that settles upstream of the dam;

- Uninterrupted functioning of the fish "paths" must be given priority over the production of electricity, which means that in the case of minimal flows, the turbines must be suspended so that there is enough water in the fish paths;
- Mentioned bases and fishing "tracks" as a whole must be adequately secured, including the entrance and exit parts, in order to prevent unauthorized access by persons and installation of any fishing equipment;
- Fish "paths" must be regularly cleaned of any sediment that can hinder the movement of aquatic organisms;
- In case of clogging of fish "paths" or other accidents that lead to its failure, the hydroelectric power plant/small hydroelectric power plant must stop working until the causes of this phenomenon are eliminated;
- Cumulative impacts of a large number of small hydropower plants should be planned separately if they are planned on the same watercourse;
- Use dust reduction techniques on unpaved and overgrown surfaces;
- Implement a speed limit in order to reduce the emission of dust into the air during the construction phase;
- Replant damaged areas as soon as possible;
- After construction, isolate the buildings in order to reduce the noise produced by turbines, generators and transformers;
- Use terrain topography and vegetation as visual barriers to prevent visual impacts.
- In order to protect ornithofauna and bats, special attention should be paid to detailed considerations of flying fauna when choosing the location of wind farms through the elaboration of monitoring of ornithofauna and chiroterofauna;
- Mark power line cables with conspicuous objects, such as coloured balls or flags at key crossings or other areas where the power line crosses important bird migration corridors;
- When choosing the location of the wind farm, special attention should be paid to ensuring the necessary distances from ecologically sensitive locations in order to minimize possible negative impacts on biodiversity;
- When choosing the location of the wind farm, special attention should be paid to avoiding potential shadow effects and impacts on landscape features and agricultural production;
- Monitoring of ornithofauna and chiroterofauna should be carried out in all phases of project development and during its functioning;
- Filters should be used in biomass power plants to reduce emissions from combustion devices;

- Biomass power plants can be isolated to reduce the noise of turbines, generators, pumps, transformers, etc.;
- When choosing a location for biomass power plants, special attention should be paid to ensuring the necessary distances from ecologically sensitive locations in order to minimize possible negative impacts on biodiversity;
- When choosing a location for solar power plants, an EISA should be conducted;
- To the extent that it is feasible, solar power plants and accompanying facilities should be integrated into the environment;
- The installation and operation of panels in the solar field should be arranged in such a way as to avoid high intensity of light (glare), and where it is unavoidable to install a fence with suitable materials;
- The lighting of the object should be minimal for safety reasons and should provide protection against light scattering (light pollution);
- Timed motion sensors should be used whenever possible.
- During the construction and operation of the geothermal power plant, special attention should be paid to reducing the effect of noise and vibrations.
- The impact of each project on the biodiversity of the area (individually and cumulatively) should be examined thoroughly in the Environmental & Social Impact Assessment Study of the planned project, which should identify the species of local, national or international importance that may be endangered both from the implementation of the proposed project, as well as the cumulative effect of the relevant infrastructure of each area and to formulate all the necessary measures to prevent / deal with / remedy the effects.
- The planning to be in fully compatible with national legislation, such as Law on Nature and Wildlife Protection and Law on the Protection and Management of Wild Birds; detailed ecological assessments should be conducted where required, in accordance with legislation.
- During the design phase, selection of appropriate location, so as to avoid as much as possible the location of infrastructure within protected areas or in close proximity to protected areas that may be adversely affected. Where this is not possible, an effort should be made to ensure that the integrity and coherence of the site itself, as well as the continuity between sites with relevant management objectives and characterization, are minimally affected during project design.
- Take corrective measures to facilitate the movement of fauna. In addition, appropriate remedial measures should be implemented in case the infrastructure is located in places with forest or natural vegetation and integrated phyto-technical intervention programs should be implemented in the new or upgraded infrastructure.
- Overhead objects - transmission lines are sensitive objects of technical infrastructure, above all in relation to the forest and landscape, so routing and construction must be carried out with

minimal cutting of forest and low vegetation, careful landscape design and grassing of the surface with autochthonous lawns, as well as mandatory restoration damaged cover;

- Afforestation, nature and climate-oriented forest management, smart approach to forestry, conversion of coppice forests into tall forests;
- Recovery/completion of the production process for overripe stands;
- Defining guidelines for reducing biotic and abiotic factors;
- Introduction of additional measures such as anaerobic digestion and precise planting;
- Increasing areas under organic and other ecologically acceptable systems of agricultural production;
- Research, training and raising awareness to improve the resistance of Serbian forests to climate change;

5.2.2 Measures for atmosphere and climate change

To prevent and minimize the effects of the implementation of the INECP on the Atmosphere and Climate change, the following are proposed:

- During the design phase and the location of the new or upgraded infrastructure, the best available practices should be taken into account for the reduction of air pollution and GHG emissions.
- Increase the use of renewable energy in relation to fossil fuels;
- Gradually reduce the consumption of substances that damage the ozone layer in accordance with the adopted reduction plan;
- Improve energy efficiency;
- Establish a national body for energy efficiency;
- Create action plans for climate emergency situations,
- Improve the existing system of monitoring, studying and forecasting climate change through the formation of monitoring units at local levels of administration;
- Encourage revisions of existing and introduction of new methods in the process of applying climate data and information in planning and design;
- Plan all infrastructure projects taking into account potential climatic phenomena in the area of the plan;
- The design must be implemented in accordance with the guidelines from the national plan for adapting to climate change;

- Perform control of air quality and GHG at construction sites;
- Research and development of innovative solutions for the prevention and management of natural disasters;
- Reforestation and restoration of damaged ecosystems;
- Diversification of crops in order to better adapt to climate change;
- Improvement of agricultural land irrigation;
- Creation of regional and local risk maps of natural disasters related to observed and projected climate changes in order to integrate climate changes into national and local plans for the protection of the population, material goods, environment and natural resources;
- Define zones vulnerable to climate change in order to structure adaptation measures and protection measures, revise sector strategies (in the area of population health, natural resources and environmental protection) in order to include climate change as an important factor of sustainable development in sectors vulnerable to climate change;
- Introduce incentive measures, reverse auctions and other market-based mechanisms and financial instruments to accelerate investments in clean energy;
- Promotion of the circular economy and bioeconomy, which will also contribute to achieving the goal of mitigating climate change. The transition to a circular pattern can lead to significant reductions in GHG emissions through recycling and reuse of materials, more efficient use of resources and more environmentally friendly product design, as well as the introduction of new circular business models, especially in industry, transport and the built environment;
- Promoting innovations and technologies for sustainable energy development. Technology is one of the key means of reducing or slowing growth and stabilizing the concentration of greenhouse gas (GHG) emissions. To this end, technological innovation, especially when promoted in partnership with the private sector, can help create or expand markets for green products and services, create jobs and support economic growth, while contributing to the reduction of GHG emissions;
- In promoting innovation and technology, focus on four areas: decentralized renewable energy with energy storage, electric drive technologies and electric mobility, accelerating the adoption of energy efficiency and clean technology innovation.
- Promoting ecological industry, agriculture, fisheries and animal husbandry, food sustainability, responsible consumption and
- Promote clean technologies of electricity production from coal;
- Selective mining and washing of coal and efficient use of coal
- Commercialize technologies such as solar energy, wind, small hydroelectric power plants, bioelectric power plants and geothermal energy;

- Electrification of industrial processes;
- Efficient use of means of transport (electric public transport, bicycle, shared cars);
- Introduce standards for consumer devices and equipment, such as lighting, air conditioners, etc.;
- Raising public awareness of climate change.

5.2.3 Measures for acoustic environment

In order to prevent and minimize the effects of the implementation of the INECP on the acoustic environment and human health, the following are proposed:

- In the case of construction of new infrastructure or repair / improvement / upgrading of existing ones, all those technical specifications and the best available techniques should be taken into account so that during the construction and operation phases the noise levels are minimized, the safety conditions are maximized, and accidents are prevented.
- During the implementation of actions and operation of projects it is proposed to design and operate noise emission monitoring programs (especially close to residential areas) based on the relevant environmental conditions, so as to detect exceedances and offset with the use of appropriate measures.
- Use of advanced technologies during the operation of the proposed infrastructure or projects, so as to minimize noise within or near residential areas, areas with intensive production or economic activities and of environmental / ecological interest.
- When choosing the location of energy facilities, special care should be taken to ensure the necessary distances from the nearest settlements and residence buildings in order to minimize the possible negative effects of noise on the population;
- During the construction of energy facilities, it is mandatory to comply with the Law on Protection from Noise in the Environment ("Official Gazette of the RS", no. 36/09, 88/10 and 96/21), as well as by-laws adopted on the basis of this Law;
- During the construction phase of buildings, use technically correct construction machinery. Activities should be carried out during the day, i.e. during the scheduled working hours without extension, so as not to disturb the local population;
- Ensure that the noise emitted under the prescribed conditions of use and maintenance of construction machinery and equipment, i.e. during the performance of planned activities, does not exceed the prescribed limit values;
- Regularly maintain equipment that emits increased noise;
- Limit noise by turning off construction machinery and equipment when there is no need for their operation;

- After construction, isolate energy facilities in order to reduce the noise produced by turbines, generators and transformers;
- On all equipment used in the technological process, collective protection measures are implemented in accordance with the Rulebook on preventive measures for safe and healthy work when exposed to noise ("Official Gazette of RS", no. 96/11, 78/15 and 93/19) and the Rulebook on preventive measures for safe and healthy work when exposed to vibrations ("Official Gazette of RS", no. 93/11 and 86/19) and international conventions;
- Biomass power plants can be isolated to reduce the noise of turbines, generators, pumps, transformers, etc.;
- During the construction and operation of the geothermal power plant, special attention should be paid to reduce the effect of noise and vibrations.

5.2.4 Water protection measures

To prevent and minimize the effects of the implementation of the INECP on the water resources, the following are proposed:

- In the case of construction of new infrastructure and expansion / improvement / upgrading of existing ones, during the design stage it should be foreseen that any intervention includes all the necessary measures and technical infrastructure so as not to have significant effects on the aquatic environment due to pollution (quantitative or qualitative) or changes of the hydrographic network.
- During the construction and operation phases of the infrastructure, the design and implementation of an integrated waste management plan (solid and liquid) is proposed.
- During the implementation of the actions, the construction and operation of the projects, it is proposed to implement a water quality monitoring program in places adjacent to the interventions.
- At points where the accessibility axis cross important water recipients, the installation and operation of Pollution Control Units (PCU's) is recommended.
- During the construction of buildings, it is necessary to adhere to good construction practices in order to avoid a negative impact on groundwater;
- During placement, construction and exploitation of facilities and devices, it is necessary to check the potential impact of facilities on pumping stations for drinking water with issued water permits, water protection areas, and ensure all necessary measures to protect these resources;
- When using geothermal sources, all preventive measures must be implemented to preserve the quantity and quality of geothermal sources;
- Wastewater from the production process must be treated to the prescribed level in accordance

with the relevant legal regulations before being discharged into the recipient;

- Appropriate measures to protect water resources should be implemented already in the planning phase and checked in the context of issuing water conditions and issuing building and water permits;
- In areas where there is a possibility of flooding and which shows a tendency to slide, a policy to prevent collapse / landslides can be adopted to reduce the risk of such an event after filling the reservoir;
- Increasing the availability of quality water through the increase of the population's connection to public water supply system;
- Reduction of losses in water supply systems;
- Protection and improvement of water quality in reservoirs intended for water supply;
- Improving the state of water quality in watercourses, primarily through the construction and more efficient operation of existing wastewater treatment facilities, as well as controlled use of fertilizers and plant protection agents;
- Sanitation and remediation of polluted watercourses;
- Establishment of economic valuation of water and services, applying the "polluter pays" and "user pays" principles;
- Corresponding institutional and territorial organization of the water sector;
- Defining the legal status and ownership transformation of water management companies;
- Solving the problem of municipal wastewater, according to the public-private partnership model for larger cities, and through state investment activities for smaller settlements;
- Definition of source zones and determination of zones and sanitary protection measures of all sources (republican, regional and local) of surface and underground waters.
- Mandatory preservation of surface and underground water quality in accordance with the required class;
- Improving the systematic measurement and monitoring of the quality of surface water and ground water, developing the culture of the population about the need to preserve water resources;
- Implementation of restrictive measures in order to preserve water in source areas and in areas of special natural or environmental importance;
- Rationalization of water consumption by individual consumers; control of the quality of drinking water (physical-chemical and microbiological standards) by professional services at the local level;
- Wastewater from commercial facilities must meet effluent standards;

- Removal and treatment of municipal wastewater in settlements;
- Increasing the degree of connection to public sewage systems;
- Establishment of a reference laboratory for water testing;
- Protection of mountain rivers and controlled construction of MHE while respecting natural values and considering the cumulative and synergistic effects of several MHE on one watercourse.
- Poverty reduction as a contribution to the fight against desertification and mitigating the consequences of drought;
- Improving subregional, regional and international cooperation between parties affected by drought in the field of environmental protection and conservation of soil and water resources.

5.2.5 Soil protection measures

To prevent and minimize the effects of the implementation of the INECP on soil, the following are proposed:

- Appropriate design to use degraded areas and soils instead of productive soils.
- Integrated planning is required that will emphasize both the selection of the appropriate location of the interventions (based on soil criteria) and the appropriate lining of the soil with vegetation, which will be formulated and checked in the ESIA of the respective projects. In this way, the protection of vulnerable soils (loose soils and areas with erosion and desertification have been identified) will be sought, as well as the protection of the soil with the necessary stability measures such as planting with endemic plant species of high resistance (proposed application of appropriate planting as the preferred option for the protection of disturbed soils, as both landscape upgrading and vegetation / biodiversity restoration are achieved).
- When constructing buildings, it is necessary to follow good construction practices in order to avoid a negative impact on the soil;
- Establish continuous supervision during the execution of works with the presence of an environmental protection specialist;
- During the construction works, the measures of planned and safe collection of all unnecessary materials (waste), their transport and disposal at the nearest landfill must be observed;
- Prohibition of solid or liquid waste disposal, during the construction of the projects, on the ground. Collection and disposal in accordance with applicable legislation.
- Prohibition of unorganized waste disposal and closure of unorganized waste disposal sites in order to protect the soil;
- Controlled application of chemical agents in agricultural production and agrotechnical

measures;

- Protection from wind erosion (by forming protective belts);
- Reduced risk of soil erosion by carrying out anti-erosion works and introducing effective measures for erosion control;
- Remediation of contaminated locations from the priority list;
- Development of a system for monitoring, protection and improvement of soil quality by polluters;
- Development of modern standard operating procedures and instructions for fulfilling obligations in the field of soil protection;
- To the greatest extent possible, preserve plant cover, that is, leave buffer zones formed by plant cover between the planned access roads and watercourses;
- All surfaces of the construction site and other zones of temporary influence must be rehabilitated after the completion of the construction works in accordance with the Rehabilitation Plan and brought back to their original condition and/or, if possible, to a condition that corresponds to the future use of the space;
- Protect agricultural land from degradation and change of use.
- Prevention of further soil loss and preservation and improvement of its quality, especially in the zones of influence of industrial, mining, energy, traffic and other activities;
- Choose safer locations for the construction of new facilities and infrastructure;
- Building facilities and infrastructure that is safer and more sustainable;
- Restoration of the natural landscape;
- Adjustment of production processes to environmental requirements;
- Treatment of all wastewater, which will be reintroduced into the technological process by recirculation and reuse;
- Establishment of incentive measures for the improvement of agricultural production; protection and use of agricultural land;
- Establishment and maintenance of the information system on agricultural land in the Republic of Serbia;

5.2.6 Landscape protection measures

To prevent and minimize the effects of the implementation of the INECP on landscape, the following are proposed:

- During the design phase, selection of appropriate location of activities so that any interventions include all the necessary measures to minimize the impact on the natural, aesthetic and cultural character of the landscape as well as to avoid fragmentation of the landscape. Where changes or disturbances take place, then restoration activities should be performed.

- Implement the European Convention on the Landscape (ECP) and identify and characterize the landscape on the territory of the Republic of Serbia with the aim of recognizing the landscape, formulating a comprehensive landscape policy and integrating it into the legal basis, participation and strengthening public awareness of the landscape and international cooperation on landscape issues;
- Create an Action Plan for the implementation of ECP in accordance with the proposal of the Rulebook on the criteria for the identification of landscapes and the method of assessing their significant and characteristic features;
- Identify and evaluate the character types of the landscape of the Republic of Serbia;
- Form an integral database of spatial data on significant and characteristic features of the landscape of the Republic of Serbia, based on data from several sectors (forestry, agriculture, water management, nature protection, environmental protection, etc.).
- Appropriate colored materials for objects should be selected to fit into the landscape;
- If it is necessary to cross over a certain panoramic area, above-ground objects should be integrated into the environment in order to reduce the negative visual impact to the smallest size;
- Information about the project area along the transmission line route should be researched;
- Within the green belt, it is necessary to remove and replace damaged or dry vegetation with the same specimens of the species, in accordance with the greening project;
- Interventions in the space should disturb the natural and ambient characteristics of the space as little as possible;
- Construction and infrastructure facilities during planning and design must fit in the landscape,
- Cultural heritage protection measures

In order to prevent and minimize the effects of the implementation of the INECP on cultural heritage, the following are proposed:

- Protection of protected and intended for protection cultural assets in cooperation with competent institutes for the protection of cultural monuments in the process of planning and designing;
- In terms of archaeological sites and historical and cultural heritage, it is necessary to research data on possible endangered areas;
- When installing solar systems, it is necessary to take into account the regimes for the protection of cultural heritage, since their location on certain buildings is allowed, but not on others.

- During the design phase, selection of appropriate location of activities so as not to affect areas of cultural interest. The rules for design must be fully compatible with the requirements of the legislation for the cultural protection of the country.
- Utilization of opportunities provided by actions to improve accessibility, for the promotion and protection of natural and cultural heritage. Preservation of any elements of interest along the infrastructure with extensive research and excavation before the start of work.

5.2.7 Cultural heritage protection measures

In order to prevent and minimize the effects of the implementation of the INECP on cultural heritage, the following are proposed:

- Further improve the attractiveness of residence in areas related to the implementation of the proposed interventions both through interventions in residential centres, as well as by creating development prospects, jobs and implementation / upgrading access to basic services.
- In terms of archaeological sites and historical and cultural heritage, it is necessary to research data on possible endangered areas;
- When installing solar systems, it is necessary to take into account the regimes for the protection of cultural heritage, since their location on certain buildings is allowed, but not on others.
- During the design phase, choose a suitable location for the activities so that they do not affect areas of cultural interest. The rules must be fully compatible with the requirements of the country's cultural protection legislation.
- Using the opportunities provided by actions to improve accessibility, to promote and protect natural and cultural heritage. Preservation of all interesting elements along the infrastructure with extensive research and excavation before the start of work.

5.2.8 Measures for the protection of population and material assets

In order to prevent and minimize the effects of the implementation of the INECP on human health and material assets, the following are proposed:

- Further improve the attractiveness of housing in the areas related to the implementation of the proposed interventions both through interventions in residential centers and through the creation of development perspectives, jobs and the implementation/upgrade of access to basic services
- In the immediate vicinity of the infrastructure, control is required for the occurrence of significant effects (such as exceedance of noise levels or gas emissions) based on the relevant environmental conditions, so as to detect exceedances of the limits and to deal with them using appropriate measures, such as the use of sound barriers in / near residential areas, areas with

intensive productive or economic activities (eg tourist interest) and environmental / ecological interest where the institutional limits are expected to be exceeded and which will be judged from the evaluation of the ESIA of the respective projects.

- At the design stage, efforts should be taken not to degrade the value of land and assets by improving accessibility in intervention areas and highly degraded areas.
- Prevent the occurrence of illegal construction in the zones of energy facilities, because it represents the biggest problem related to the impacts of power facilities on the population. Although additional funds are invested and facilities are built to the highest quality in such a way that the impact is minimal and does not disrupt people's lives and work, there is a huge number of facilities that subsequently appeared in the zones of power facilities, which are not harmonized nor do they have operator consent or construction permits. even though they have all been reported to inspections for decades, not a single building in the corridor has ever been demolished. Such a situation renders any orderly and planned construction of infrastructure meaningless
- Households that are directly threatened by the implementation of energy facilities: (coal mines, thermal power plants, railways and road transport, construction of hydroelectric power plants, solar power plants, wind farms, etc.), transfer to environmentally safe locations. If displacement of immovable property is unavoidable (land, residential buildings, ancillary and other facilities, such as animal accommodation facilities), property owners must be compensated in accordance with relevant laws. The compensation must be effective in terms of ensuring that the affected households improve their standard of living over a longer period of time;
- Special attention must be paid to the vulnerable part of the population, who have difficulty adapting to resettlement on their own, and provide for special measures to support vulnerable people such as the elderly, disabled, chronically ill and people with special needs;
- In order to secure financial resources in a timely manner, develop programs and/or relocation plans, as a prerequisite for the construction of energy facilities and the development of the electric power system;
- The resettlement plan should include measures that would ensure acceptable living conditions in the new location, as well as suitable opportunities for employment in the environment of the new location and the promotion of active participation of young people, especially women in the labor market;
- The investor must form an organizational unit for communication that will develop a database of affected families in order to enable regular supervision of the resettlement plan in order to report and assess the quality of the assistance provided;
- In accordance with the Law on Expropriation ("Official Gazette of the RS", No. 53/95, "Official Gazette of the FRY", No. 16/2001 - decision of the SUS and "Official Gazette of the RS", No. 20/2009, 55 /2013 - US decision and 106/2016 - authentic interpretation) the government can determine the public interest in the case when the expropriation of immovable property is

necessary for the exploitation of mineral resources, to ensure environmental protection and protection from natural disasters, including the construction of buildings and the execution of works for these needs, as well as for the acquisition of undeveloped land required for the purpose of resettlement of a settlement or part of a settlement, if there is a public interest in the area of that settlement or part of the settlement for the expropriation of immovable property for the exploitation of mineral resources, as well as in other cases provided for by law.

- When choosing the location of the wind park, special care should be taken to ensure the necessary distances from the nearest settlements and buildings in order to minimize the possible negative effects of noise on the population;
- When choosing a location for biomass power plants, special attention should be paid to ensuring the necessary distances from the population in order to minimize possible negative impacts on the health of the population;
- Obey laws on public safety and health;
- Regularly monitor the health condition and quality of life of the local population, especially in locations where the intensification of coal exploitation, electricity production from fossil fuels, etc. is planned.
- Intensification of the implementation of preventive health measures, in accordance with the Public Health Strategy and annual reports on the health status of the population, as well as on pathology and the impact of individual pollutants.
- Implementation of special health care measures for vulnerable categories - younger and older population, immunocompromised population, etc.
- During all activities related to the implementation of INECP, the precautionary principle should be taken into account, which is achieved by planning and consistent implementation of measures prescribed by law to reduce the possible impact on the health of the population;
- Establish mechanisms for comprehensive and continuous monitoring of the effects of environmental factors on health;
- Establish a system of health risk assessment originating from the most important environmental factors (air, water, noise and foodstuffs);
- Improve preventive activities to protect the health of the population on the territory of the Republic of Serbia.

At this point it should be stressed that the specialization of the remedial measures for each area takes place in the phase of the environmental permitting of the individual projects.

6 GUIDELINES FOR THE DEVELOPMENT OF STRATEGIC IMPACT ASSESSMENTS AT LOWER LEVELS OF HIERARCHY

According to Article 16 of the Law on Strategic Environmental Impact Assessment, the Report on strategic assessment includes developed guidelines for plans and programmes at lower hierarchichy levels that include defining the need for strategic assessment production and impact assessment of projects to environment. The guidelines also define the aspects of environmental protection and other questions of relevance for environmental impact assessment and lower hierarchy level plans and programmes.

For all planned capital energy facilities: hydropower plants (especially refers to a large number of hydropower plants or small hydropower plants whose construction is planned on the same watercourse), thermal power plants, cogeneration plants, energy facilities using RES that are grouped in the same area, surface mines, portable and large-capacity distribution networks, warehouses, pipelines, etc., whose spatial dispersion of impacts exceeds local/microlocation levels, and where synergistic impacts may occur, **appropriate planning documents that require the creation of a Strategic Environmental Impact Assessment and technical documentation that require the creation of Environmental impact assessment studies,** in order to take a broader view of possible environmental impacts, with cumulative and synergistic impacts, and define appropriate planning and technical protection measures to mitigate possible negative impacts.

In accordance with the provisions of the Law on Environmental Impact Assessment (Official Gazette of the Republic of Serbia, No. 135/04 and 36/09) developing of a EIA may be requested at the level of design and technical documentation for individual energy facilities. In relation to the planned activities defined by the Strategy, based on the Decree on the List of Projects for Which the Environmental Impact Assessment Is Mandatory and the List of Projects for Which the Environmental Impact Assessment May Be Requested (Official Gazette of the Republic of Serbia, No 114/08), **the Environmental Impact Assessment is mandatory for the following projects:**

1. Facilities for petroleum refining, oil products and natural gas;
2. Facilities for gasification and melting of coal or bituminous shale, heavy residue of crude oil; facility for roasting or sintering metal ore;
3. Facilities for producing crude iron or steel, including continuous casting, with the capacity exceeding 2.5 t/h;
4. Processing facilities in ferrous metallurgy;
5. Facilities for production of raw non-ferrous metals from ore, concentrates or secondary raw

materials through metallurgical/chemical processes or electrolytic processes

6. Facilities for the electricity production, steam, hot water, industrial steam or heated gases, using all types of fuels, including facilities for the drive of operating machines (thermal power plants, heating plants, gas turbines, plants with internal combustion engines and other combustion devices, including steam boilers) with the power of 50 MW or more;
7. Facilities for the treatment of hazardous waste by incineration, thermal and/or physical, physical/chemical, and chemical procedures;
8. Facilities for the treatment of non-hazardous waste by incineration or chemical procedures with the capacity over 70 t per day; municipal waste landfills for over 200,000 inhabitants equivalent;
9. Extraction of oil and natural gas;
10. Dams and other facilities for the retention and storage of water, where the water that flows to them, or is additionally retained, or water in the reservoir, exceeds the quantity of 10 million m^3;
11. Pipelines for the transport of gas, liquefied gas, oil and petroleum products or chemicals with the diameter exceeding 800 mm and length exceeding 40 km;
12. Open-cast mines of mineral raw materials whose surface area exceeds 10 ha, or peat extraction when the surface area for exploitation exceeds 100 ha;
13. Construction of overhead power lines with voltage of 220 kV or higher, and whose length exceeds 15 km;
14. Facilities for storing oil, natural gas, flammable liquids and fuels with the capacity of 100,000 t or above;
15. Construction of main highways and roads with four or more lanes, or reconstruction and/or expansion of an existing road with two or fewer lanes, with the aim to obtain a road with four or more lanes, in case such a new road or reconstructed and/or expanded section have an interrupted length of 10 km or more, including the accompanying facilities, except for the accompanying content of the main road;
16. The exploitation of groundwater or enrichment of groundwater, where the annual volume of exploited or enriched water equals or exceeds 10 million m^3;
17. Hydrotechnical facilities for inter-basin transfer, intended for the prevention of possible shortage of water, where the quantity of moved water exceeds 100 million m^3 per year;
18. Inter-basin transfer facilities where the multi-year average discharge in the basin from which the water taken, exceeds 2,000 million m^3 /year, and where the quantity of transferred water exceeds 5% of this discharge, except in the case when drinking water is transported by pipelines;
19. Wastewater treatment plants in settlements with over 100,000 inhabitants;
20. High-capacity facilities for intensive poultry or pig farming;

21. Industrial plants for cellulose production using wood pulp, straw or similar fibrous materials; paper and cardboard with production capacity exceeding 20 t/day;
22. Activities and facilities for which an integrated license is issued, in accordance with the Decree on the Types of Activities and Plants for Which an Integrated Licence Is Issued (Official Gazette of the Republic of Serbia, No 84/05);
23. Projects realised at protected national resource and protected surroundings of cultural value, and in other special-purpose areas;
24. Other plants with possibility of GHG emissions.

For other energy, infrastructure and other facilities, and activities with lower capacity, the promoter of the project is required, in accordance with Article 8 of the Law on Environmental Impact Assessment, to contact the Environmental Protection Authority with a Request for a decision on the need for impact assessment Study, in accordance with the Law on Environmental Protection (Official Gazette of the Republic of Serbia, Nos 135/04, 36/09, and 72/09 – 43/11 – Constitutional Court), Law on Environmental Impact Assessment (Official Gazette of the Republic of Serbia, Nos 135/04 and 36/09), Rules on the Content of an Environmental Impact Assessment study (Official Gazette of the Republic of Serbia, No 69/2005) and Decree on the List of Projects for which the Environmental Impact Assessment Is Mandatory and on the List of Projects for which the Environmental Impact Assessment may be requested (Official Gazette of the Republic of Serbia, No 114/08).

For all projects/facilities for which, prior to the adoption of the Decision on consent to the EIA concerned, an impact assessment study was developed and consent of a competent authority for environmental protection activities was received, the propositions formulated in these studies apply, particularly in the part pertaining to the measures for reducing negative impacts and the environmental impact monitoring programme.

7 ENVIRONMENTAL MONITORING PROGRAM DURING THE IMPLEMENTATION OF THE INECP

7.1 INTRODUCTION

The following section provides for the ongoing monitoring of the effects of the implementation of the INECP. Monitoring is carried out by reporting on a set of indicators, which enable positive and negative impacts on the environment to be measured. As part of the SEA study, a set of proposed indicators of relevance to the INECP were identified and are presented below.

The explicit reason for monitoring is to identify unforeseen effects from the implementation of the INECP and to undertake remedial action. But monitoring has other benefits, and it is recommended that monitoring be used to:

- Compare predicted and actual effects, thus providing information for the improvement of future SEAs (i.e., a quality control tool)
- Check that environmental conditions imposed by the authorities are being complied with
- Check that the plan or programme is implemented as described, including the prescribed measures to prevent, reduce or mitigate adverse effects
- Check whether the proposed remedial / prevention measures are effective.

Article 10 of the Directive 2001/EC (Monitoring) aims to extend the period of identifying and assessing environmental impacts process beyond the preparation phase of the INECP and during its implementation phase, establishing the obligation to monitor the significant environmental impacts at the local level. If the SEA has identified significant negative impacts, then measures to minimize them should have been proposed. Thus, monitoring provides a) the possibility of comparing the predicted results of the environmental impact assessment of the SEA with the actual environmental impacts and b) the assessment of the effectiveness of the impact minimization measures implemented during the implementation of the INECP.

The directive and national legislation do not specify how to monitor the significant environmental impacts, the time and frequency of monitoring, or the methods to be used. However, the goal of monitoring is clearly and effectively defined, which is to identify at an early-stage unforeseen adverse effects, and to be able to undertake appropriate remedial action.

It is noted that the Law on Strategic Environmental Impact Assessment specifies the obligation for defining a monitoring programme for environment during the implementation of a plan or programme for which the Strategic Assessment is conducted. The Law also prescribes the content of the monitoring programme, which contains in particular:

- description of planning and program objectives;
- indicators for monitoring the environment;
- rights and obligations of competent authorities, etc.

In addition, .according to the Law on Environmental Protection, the Government issues a monitoring programme based on special laws for a two-year period for the territory of the Republic of Serbia, and the local government issues a programme for monitoring the environment of its territory, which has to be aligned with the above Government programme.

Continuous monitoring is particularly important, in zones where there is a possibility to overload the capacity of the environment and damage of human health. These are the areas of exploitation of mineral raw materials, open-cast mines and energy facilities (particularly thermal power plants), water management facilities and other projects, particularly those located near or in protected areas.

7.2 INDICATORS FOR ENVIRONMENTAL MONITORING

Environmental monitoring is carried out by systematic measurement, examination and assessment of environmental pollution indicators, which includes monitoring of natural factors, changes in the environment and its characteristics. Regulation on the content and way of managing the information system, methodology, structure, common bases, categories and levels of data collection, as well as the content of information that is regularly and obligatorily notified to the public ("Official Gazette of RS", number 112/09).

Considering the spatial coverage of INECP, the monitoring system mainly refers to the indicators shown in Table 7.1.These indicators will be used in combination with the indicators presented in Table 6.5 for monitoring the achievement of strategic assessment objectives.

Table 7.1: Indicators for environmental monitoring

SEA area	Indicators
CLIMATE CHANGE	1. Frequency of daily values of SO2, NO2, PM10 and O3 exceeding the limit*
	2. Use of substances that damage the ozone layer (ODS)
	3. Annual air temperature
	4. GHG emissions (CO2, CH4)

	5. Percentage of renewable energy sources in the energy balance (%)
HUMAN HEALTH AND QUALITY OF LIFE	1. Quality of drinking water*
	2. Percentage of population exposed to increased air pollution
	3. Percentage of budget financial allocations for climate change adaptation and mitigation measures
	4. Investment and current expenses*
NATURAL AND OTHER DISASTERS	1. Interventions in flooded areas
	2. Potential new sources of disasters
NATURAL RESOURCES	1 Minimum and average flows in watercourses (m³/s)
	2 Serbian Water Quality Index (SWQI) *
	3 Emissions of pollutants from point sources into water bodies*
	4. Change in the watercourse quality class (%)
	5 Use of water in households*
	6 Water losses*
	7 Re-used and recycled water*
	8 Lowered level of groundwaters (m)
	9 Change in noise levels.
	10 Percentage of population exposed to noise levels higher than those provided for in national legislation
	11 Change in the arable land area (%)
	12 Consumption of mineral fertilizers and plant protection substances*
	13 Area, stands of trees and types of forests: changing trend in the forest-covered areas*
	14 Area, stands of trees and types of forests: percentage of forest area in comparison to the total area*
	15 Area, stands of trees and types of forests: forest areas for commercial use*
	16 Damage in forests*
NATURE	1 Endangered and protected species*
	2 Diversity of species*
	3 Protected areas*
CULTURAL HERITAGE	1. Number and importance of cultural heritage threatened by climate change
LANDSCAPE	1 Number of protected landscapes affected by actions / projects developed
SOCIAL - ECONOMIC STABILITY	1. Reduction of the unemployment rate as a result of structural changes (%)

	2. Green and recreational areas in cities per 1,000 inhabitants
	3. The number of settlements that need to be displaced due to various impacts of climate change
	4. Number of buildings for demolition (% of the total number) due to causes (floods, coal production, landslides, etc.)

* The definition and description of this indicator, including the calculation methodology, are given in the Regulation on the National List of Environmental Indicators (2011).

Monitoring system for air quality control

The purpose of air quality examination and monitoring is controlling and identifying degree of air pollution and establishing a pollution trend, in order to act in a timely manner towards reducing harmful substances to a level that will not significantly affect the environment quality and human health. The legal basis for air quality monitoring is the Law on Environmental Protection (Official Gazette of the Republic of Serbia, No 135/04, 36/09 and 72/09 – 43/11 – Constitutional Court, 14/16, 76/18, 95/18), Law on Ministries (Official Gazette of the Republic of Serbia, No 128/20 and 116/22), Law on Air Protection (Official Gazette of the Republic of Serbia, No 36/09, 10/13 and 26/21).

Air monitoring standards and methods are prescribed by the Decree on monitoring conditions and air quality requirements (Official Gazette of the Republic of Serbia, No 11/10, 75/10 and 63/13) adopted under the Law on Air Protection. The subject of systematic measuring are certain inorganic substances, sediment matter in the air, heavy metals in suspended particulate matter, organic matter, carcinogens. The Decree also prescribes the matter that defines the quality of ambient air, warnings and episodic pollution, locations and rate of sampling, and the limit values of the above pollutants. Based on the same Law, the Government determines two year air monitoring programmes, according to which systematic air quality measurements are performed on the main and local station network. In view of the type and character of the planning solutions, natural and anthropogenic features of the planning area, and estimated insignificant and small impacts of those solutions on air quality, it is believed that occasional or seasonal ambient air quality measurements, in large settlements and near main roads, would be satisfactory. Those programmes will be realised out by the Environmental Protection Agency (SEPA) and the local responsible public Institution for health protection.

Monitoring system for water quality control

The main document for water quality monitoring is the Annual Water Status Monitoring Programme, based on Articles 108 and 109 of the Water Law (Official Gazette of the Republic of Serbia, no: 30/10, 93/12, 101/16, 95/18), where it is specified by a government decree at the start of a calendar year for that year. The programme is realised by the Republic Hydrometeorological Service of Serbia (RHSS) and Serbian Environmental Protection Agency (SEPA). Monitoring incorporates for surface water – volume, water levels and discharges to the level significant for the environmental and chemical status and environmental potential, as well as parameters of environmental and chemical status and environmental potential; for groundwater – levels and control of chemical and quantitative status.

Through the Plan implementation, the obligation to expand the network of observation locations and responsibility for additional water status monitoring, need to be specified. Monitoring of water facilities used for public water supply is carried out by territorially responsible Institutes for health protection (at the level of local government units, where applicable), and the monitoring scope and type is adapted to the realisation rate of planning solutions in the area of securing municipal water supply needs. For water bodies from which an average of more than 100 m3 /day can be seized, which are by the water supply management plan, intended of drinking water and water for sanitary and hygienic purposes in the future, provides continuous measurement of water quantity and examination of its quality. The measurement and examination are carried out by the Republic organisation responsible for hydrometeorological activities, according to the annual programme of the Ministry of Agriculture, Forestry and Water Management (based on Article 78 of the Water Law). Based on Article 74 of the Water Law, a public enterprise or another legal person carrying out water supply activities, is required to place devices and ensure constant and systematic registering of the water quantity and examination of the water quality at the water abstraction, to take measures to ensure drinking water is suitable for health and maintaining a hygiene in the object, and to take measures to ensure the technical functioning of the devices.

Monitoring sytem for soil quality control

The basis for soil monitoring can be found in the Law on Soil Protection (Official Gazette of the Republic of Serbia, No 112/15), Law on Agricultural Land (Official Gazette of the Republic of Serbia, No 62/06, 65/08, 41/09,112/15, 80/17, 95/18), the Law on Forests (Official Gazette of the Republic of Serbia, No 30/10, 93/12, 89/15, 95/18), and pertain to the examination of dangerous and hazardous matter quantities in irrigation water as well, according to the programme adopted by the relevant Minister. The examination can be carried out by persons with have the know-how and technical expertise, and by legal persons (enterprises, companies, etc.). authorised by the responsible Ministry. The Minister also prescribes the permitted quantities of dangerous and hazardous matter, and testing method. The protection of agricultural soil and the monitoring of situation are agricultural plans mandatory element, whose content, preparation manner and adoption are regulated by Articles from 5 to 14 of the Law on Agricultural Land. Monitoring the soil situation in relation to erosion processes, in particular the accumulation of materials by water, is an important instrument for the successful protection of agricultural, forest and other soil, which is as an explicit obligation set out in the Law on Agricultural Land and Law on Forests, and a principle obligation in the Law of Environmental Protection. Protection against the harmful effects of erosion and floods is also defined by the provisions of Articles 61 and 65 of the Water Law.

Monitoring system for emissions

The Law on Integrated Prevention and Control of Environmental Pollution (Official Gazette of the Republic of Serbia, No 135/04, 25/15 and 109/21) sets out the obligation of emissions/effects monitoring at their source, as an integral part of obtaining an integrated permit for facilities and activities with potential negative effects on the environment and human health, which is regulated by government regulations (Decree on the Types of Activities and Plants for Which an Integrated Permit is Issued (Official Gazette of the Republic of Serbia, No 84/05), Decree on the Content of the Programme of Measures Aimed at Adjusting the Operation of Existing Plant or Activity to Prescribed Conditions (Official Gazette of the Republic of Serbia, No 84/05), Decree on the Criteria for Determining the Best Available Techniques for the Application of Quality Standards and for Determining Emission Limit Values in the Integrated Permit (Official Gazette of the Republic of Serbia, No 84/05), and the act of the Minister in charge of environmental protection (Rules on the Content and Manner of Keeping the Registry of Issues Integrated Permits – Official Gazette of the Republic of Serbia, No 69/05)). An integrated permit issued by the authority in charge of environmental protection (at Republic, autonomous province or municipality level – depending on the authority that issued the building permit) also contains a monitoring plan, carried out by the operator (legal or natural person managing or controlling the facility, etc.).

Monitoring system of natural values

The main objective is to set up a biodiversity monitoring system, specifically natural habitats and populations of wild species of flora and fauna, predominantly vulnerable habitats and rare endangered species, as well as state and changes of the landscapes monitoring, and objects of geoheritage. All the above mentioned are under direct supervision of Institute for Nature Conservation of Serbia and Institute for Nature Conservation of Vojvodina Province from Novi Sad city, based on medium-term and annual programmes for the natural values protection. As a minimum of general monitoring is the natural values monitoring once per year. Individual monitoring activities are organised as needed, in case of unforeseen changes that may have significant negative effects. Monitoring is carried out in accordance with the provisions of the Law on Nature Protection (Official Gazette of the Republic of Serbia, Nos 36/09, 88/10 and correction 91/10, 14/16, 95/18 and 71/21) and by-laws that enable its implementation.

Monitoring system of human health

Climate change and activities leading to it, imply certain changes affecting public health. The monitoring of all previously listed environmental parameters for which monitoring is envisaged indirectly, also relates to human health, since allowed concentrations of pollutants are largely defined in relation to possible harm to human health. In addition, public health should be monitored, as well as the occurrence of health problems that may be linked to climate change. This particularly refers to areas with significant emissions of GHG and other pollutants in the air. Monitoring of human health should be carried out in accordance with the provisions of the laws governing this area:

a) The Law on Health Care (Official Gazette of the Republic of Serbia, Nos 107/05, 72/09, 88/10, 99/10, 57/11, 119/12, 45/13, 93/14, 96/15, 106/15 and 25/19) regulates the health protection system, organisation of health services, social care for public health, general interest in health care, supervision of the implementation of this Law, and other issues important for the organisation and provision of health protection;

b) The Law on Public Health (Official Gazette of the Republic of Serbia, No 15/16) regulates the scope of activity of public health, responsibilities, planning, carrying out activities related to the preservation and improvement of public health, and the manner of funding; the aim of the Law is to achieve public interest by creating conditions for the preservation and improvement of public health through comprehensive activities. In addition, the monitoring of the health of residents must be carried out on the basis of the provisions of the Public Health Strategy in the Republic of Serbia 2018-2026. (Official Gazette of the RS, No. 61/18) as a public health policy document.

Monitoring system for noise

The noise monitoring is carried out through the systematic measurement, evaluation or calculation of certain noise indicators, pursuant to the Law on Environmental Noise Protection (“Official Gazette of the Republic of Serbia”, No. 36/09 88/10 and 96/21) and other bylaws:

- Decree on Noise Indicators, Limit Values, Method for Assessment of Noise Indicators, Disturbance and Harmful Environmental Impact of Noise (“Official Gazette of the Republic of Serbia”, No. 75/10);
- Rulebook on Methodology for Determination of Acoustic Zones (“Official Gazette of the Republic of Serbia”, No. 72/10),
- Rulebook on the Methods for Noise Measurement, Content and Scope of the Noise Test Report (“Official Gazette of the Republic of Serbia”, No. 72/10),
- Rulebook on the conditions that must be met by an expert organization for noise measurement in the environment, the necessary documentation, the authorization procedure, the content of the authorization decision, as well as the content, scope and validity period of the noise measurement report ("Official Gazette of RS", no. 139/22).
- Rulebook on Contents and Methods Governing the Preparation of Strategic Noise Maps and Method of their Presentation to the Public (“Official Gazette of the Republic of Serbia”, No. 80/10),

The noise monitoring data are an integral part of the uniform information system pursuant to the law governing environmental protection.

7.3 RIGHTS AND OBLIGATIONS OF COMPETENT AUTHORITIES

As for the rights and obligations of the competent authorities, in terms of environmental monitoring, they arise from the Law on Environmental Protection, specifically its articles 69, 70, 73 and 78. According to these Articles, the rights and obligations of the competent authorities are as following:

1. The monitoring program of the Government is adopted for a two-year period.
2. The local self-government unit adopts a monitoring program for its territory, which must be in accordance with the Government's program.
3. The Republic and local self-government units provide financial means for monitoring the process.
4. The Government determines the criteria for the number and layout of measuring points, measurement network, scope and frequency of measurements, classification of monitored features, methodology and indicators of environmental pollution and their monitoring, deadlines and method of data submission.
5. Monitoring may only be carried out by an authorized organization. The Ministry prescribes more detailed conditions that must be met by the authorized organization and identifies the authorized organization after previously obtaining the consent of the Minister responsible for a certain area.
6. The Government prescribes the types of emissions and other properties that are subject to pollutant monitoring, measurement methodology, sample collection, data recording, submission deadlines and data storage.
7. National authorities, organizations and units of local self-government, authorized organizations and polluters are obliged to submit monitoring data to the Environmental Protection Agency.
8. The Government prescribes in more detail the content and way of managing the information system, methodology, structure, common bases, categories and levels of data collection, as well as the content of information about which the public must be regularly informed.
9. The information system is maintained by the Environmental Protection Agency
10. The Minister prescribes the methodology for the unified cadastre of pollutants, the type, manners, classification and deadlines for submitting data.
11. The Government annually reports to the National Assembly on the state of the environment in the Republic.
12. The competent body of the local self-government unit reports twice a year to the Assembly on the state of the environment in its territory.
13. Reports on the environment are published in the official journals of the Republic and local self-government units.

State authorities, bodies of local self-government units and authorized and other organizations are obliged to regularly, timely, completely and objectively inform the public about the state of the environment, namely about the characteristics that are monitored within the framework of quality monitoring and emissions in the ambient air, and about warning measures or the occurrence of pollution incidents that may pose a danger to human life and health, in accordance with the Law on Environmental Protection and other regulations. The public also has the right to inspect the registries of regulations or records containing information and data from National register of pollution sources and Local register of pollution sources in accordance with law.

7.4 PROPOSED PROCEDURE IN THE CASE OF SIGNIFICANT MODIFICATION OR REVISION OF THE FORESEEN ACTIONS, ACTION PLAN, OR OVERALL INECP

It should be noted that in the case of significant modification or revision of the foreseen actions, or overall INECP, a screening procedure should be carried out to determine whether the ensuing changes are likely to have significant environmental effects.

To this end, the competent Authority, at the stage of planning of the modifications/revisions, shall request an opinion from the Environmental Protection Agency. It is recommended that the request include at least:

- The description of the proposed actions,
- Details regarding:

  - the extent to which the proposed changes set the framework for projects and other activities either in terms of their location, character, size, operation or the use of natural resources,

  - the relationship of the proposed changes of national environmental legislation (eg on waste management or water resources protection),

  - the extent to which the changes influence other plans or programmes,

  - the importance of the changes for the integration of environmental issues, in particular with a view to promoting sustainable development,

  - environmental issues associated with the proposed changes.

- A description of the environmental baseline, with particular attention to the environmental characteristics of the area that may be affected by the implementation of the proposed changes, with particular emphasis on the importance and sensitivity of the area that may be affected, in terms of:

  - special natural features or cultural heritage,

- exceeding environmental quality standards or limit values,
- intensive land use.

- An overview of the importance of the impact on the environment of the proposed changes indicating:
  - the probability, duration, frequency and reversibility of the effects,
  - the cumulative nature of the effects,
  - risks to human health or the environment (eg due to accidents),
  - the size and extent of the impact area (geographical area and population size likely to be affected),
  - the impact on areas or landscapes that enjoy a special protection status at the national, Community or international level, and the potential significance of these impacts.

In the event that the Environmental Protection Agency deems, in accordance with criteria set out in national Law, that the modified/revised actions, INCEP may have significant effects on the environment, SEA will be updated.

8 OVERVIEW OF THE METHODOLOGY & DIFFICULTIES ENCOUNTERED DURING THE SEA IMPLEMENTATION

8.1 MAIN STEPS IN UNDERTAKING THE STRATEGIC ASSESSMENT

The overall SEA process is presented in ***Section 2.1 PURPOSE OF THE STUDY***.

The first step to commencing assessment, was to consider and analyse the specific plan/programme goals as well as relevant environmental protection objectives established at international, EU and National level (Section 2.2). The next step involved considering the activities proposed as part of the plan/programme, which will serve for achievement of the set goals, the previous relevant stakeholder consultations conducted as well as the relationships with other relevant programmes (Sections 3.1, 3.2 & 3.3). This was followed by the presentation and evaluation of possible alternative options for the achievement of the identified goals (Section 3.4). The next step involved the description of the current state of the environment (baseline) against which the foreseen environmental impact are to be assessed (Section 3.5). The General and Specific Environmental Objectives of the strategic assessment as well as the selected indicators for performing the assessment were presented (Section 4) followed by a detailed analysis of the likely significant effects on the environment from the implementation of the Strategy, reflecting the planned activities/measure's impact on each of the Environmental Objectives identified (Section 5.1). Likely impacts are assessed with regards to their type, probability, intensity, magnitude (spatial extent), reversibility, duration and cumulativeness of the impact using associated guiding questions. Based on the results of the analyses, the respective recommendations to prevent or mitigate potential negative impact on the environment were presented to be considered by plan/programme developers and implementers (Section 5.2). Finally, a proposed programme for monitoring of impacts of the INECP on the environment throughout its implementation is described, taking into consideration data availability (Section 7).

This following paragraph presents additional information on the main stages that were involved in performing the comprehensive impact assessment of the INECP (Sections 4 & 5.1):

Stage 1. Stage 1 includes the definition of the environmental parameters based on Directive 2001/42 and the Law on strategic environmental assessment, the objectives and the monitoring indicators, related to the project in question.

Stage 2. Next, stage 2 includes a first assessment of the potential impacts of PM under each selected Dimension of the INECP, against the environmental objectives considered relevant to the strategy in question. The process is performed through a series of questions based on whether the set environmental goals and indicators are achieved and to what extent.

Stage 3. Stage 3 includes the assessment (identification and recording) of significant impacts from specific actions or groups of activities on relevant environmental objectives and proposed impact response measures.

Stage 4. Stage 4 involves assessing the cumulative impact of the project. The analysis is done by environmental goal and group of PM based on affected INECP Dimension. After assessing the impact of the INECP as a whole, they are correlated with the current situation and the most significant cumulative / synergistic impacts, their extent and character are assessed and recorded, and

8.2 DIFFICULTIES IN UNDERTAKING THE STRATEGIC ASSESSMENT

Difficulties in implementing SEA can be divided into three main groups:

1. <u>Availability of data for the assessment of the current state of the environment</u> - which is based on existing available data published by the relevant state institutions in the form of annual reports. Some data are not up-to-date because they refer to a period of a year some time ago and do not include all environmental parameters that would contribute to a more comprehensive assessment of the state of the environment.
2. <u>There is no indicator system for environmental assessment that would correspond to the strategic planning process</u>. - which in the SEA process can be used to assess impacts with great reliability. The situation is similar with the criteria for evaluating the selected indicators. For this reason, it was decided to select the criteria from the "Core set of UN sustainable development indicators", in accordance with the Instruction of the Ministry of Science and Environmental Protection of February 2007, in accordance with the National Strategy of Sustainable Development ("Official Gazette of the Republic of Serbia", No. 57/08) which defines the principles and priorities of sustainable development and 76 indicators for monitoring Serbia's progress towards sustainable development, as well as in accordance with the Rulebook on the National List of Environmental Protection Indicators ("Official Gazette of RS", No. 37/2011), which prescribes a list of indicators related to the environment and elements of sustainable development.
3. <u>Lack of technical documentation for proposed policy measures/activities/projects</u> - the difficulty in impact assessment lies in the fact that certain proposed policy measures/projects contained in INECP, which were the subject of impact assessment, their exact locations as well as their

technical documentation for the individual projects that will be implemented in accordance with INECP are unknown, and therefore the assessment was based on possible environmental protection guidelines, which are general, but represent a good basis for the implementation of sustainable development policy in the implementation phase of INECP by taking measures to mitigate and adapt to climate change. Therefore, an environmental impact assessment will need to be conducted for these projects as soon as their specific capacities, technical characteristics and environmental conditions at the micro-location level are known.

9 DECISION-MAKING METHODS

Due to the significance of the potential negative and positive impacts of the proposed INECP on the environment, human health, social and economic status of local communities, it is particularly necessary to adequately and "transparently" involve parties concerned in the decision-making process regarding environmental protection issues at a higher level.

Article 18 of the Law on Strategic Environmental Impact Assessment stipulates that competent authorities and organizations should participate and have the opportunity to submit an opinion within 30 days.

More particularly, public participation in the process of strategic environmental impact assessment is mandatory, and the manner of its participation is prescribed in Article 18 of the Law on Strategic Impact Assessment: The body responsible for the preparation of the plan and program submits it to the body responsible for environmental protection, interested bodies and organizations for their opinion report on strategic impact assessment from Article 12 of this Law.

In general, the procedure is regulated by Article 19 of the Law. Also, in Article 20 of the Law, it is regulated that the authority responsible for the preparation of plans and programs prepares a report on the participation of interested bodies and organizations and the public, which contains all opinions from Article 18, paragraph 2 of this Law, as well as opinions expressed during public inspection and public debate on the plan and the program, that is, the report on strategic assessment from Article 19 of this law. The report referred to in paragraph 1 of this article shall be prepared within 30 days of the end of the public hearing and shall contain explanations of all accepted or rejected opinions.

Article 23 of the Law stipulates that the exchange of information on the cross-border impact of plans and programs on the environment shall be carried out by the ministry responsible for environmental protection.

Therefore, the organization of public participation of the Strategic Assessment Report of INECP is obligation of the Ministry of Mining and Energy of the Republic of Serbia, as is the authority responsible for the preparation of the INECP. The Ministry informs the public about the manner and deadlines for review of the content of the SEA Report and submission of opinions, as well as about the time and place of the public hearing organized in accordance with the law governing the procedure for the adoption of INECP.

The participation of competent authorities and organizations shall be ensured in writing and through presentations and consultations in all stages of undertaking and considering the strategic assessment. The participation of the public concerned, and non-governmental organizations shall be provided through public media and public presentations.

The Ministry of Environmental Protection of the Republic of Serbia, as the authority competent for preparing the Strategy, shall draft the Report on participation of authorities and organizations and the public concerned, which shall contain all opinions on the SEA, as well as opinions submitted during public inspection and public debate. The consultant may assist the Ministry in this task, upon request.

The SEA Report shall be submitted together with the report on expert opinions and public debate to the authority competent for environmental protection (Ministry of Environmental Protection of the Republic of Serbia) for evaluation. The evaluation shall be carried out according to the criteria specified in Annex II to the Law on Strategic Environmental Impact Assessment ("Official Gazette of the Republic of Serbia", nos. 135/2004 and 88/10). Based on this evaluation, the authority competent for environmental protection (Ministry of Environmental Protection of the Republic of Serbia) shall approve the SEA Report within 30 days from the receipt of the request for evaluation.

After collecting and processing all opinions, the authority responsible for the development of the plans/programs submits the INECP proposal, together with the SEA Report, to the competent authority (Government of the Republic of Serbia) for decision.

10 CONCLUSIONS OF THE SEA

Strategic environmental assessment is a process integrating the objectives and principles of sustainable development into the INECP, while considering the need to avoid or limit negative effects of national measures and policies in the sectors of INECP (dimensions) of decarbonisation, energy security, energy efficiency, internal energy market and research, innovation and competitiveness and sustainable environment development of the Republic of Serbia.

The strategic environmental impact assessment of INECP of the Republic of Serbia analyzed the current state of the environment, with a special focus on GHG emissions and renewable energy sources. The characteristics of the effects of the planned prioritized activities, especially the choice of the most favourable variant solution between the scenario with existing measures (WEM) and the scenario with existing measures (WAM) were the subject of the SEA. Also, other issues and problems of environmental protection according to the criteria for identifying possible significant impacts on the environment were the subject of the SEA process. The assessment process was based on an approach that considers potential impacts on a range of environmental objectives, which may arise as a result of the implementation of measures planned in the areas (dimensions) of decarbonisation, energy efficiency, energy security, the internal energy market and research, innovation and competitiveness with mitigation measures, rather than adopting a sector-oriented approach that analyses the effects of considered variant solutions in relation to sectoral policies in the field of environmental protection.

The adopted methodological approach of the SEA is based on the definition of objectives and indicators of sustainable development and the qualitative evaluation of the planned priority activities of INECP in relation to the defined SEA objectives and related indicators based on the information and level of detail available at this stage. In this context, it should be emphasized that SEA is the most important instrument in the implementation of the principles and objectives of sustainable development in the planning process. In this sense, the SEA goes beyond requirements and objectives related to environmental protection in plans and strategies. which predominantly relate to a reduction in GHG emissions created as a product of various human activities, protection of basic environmental factors and sustainable use of natural resources, as well as the prevention of waste generation, improvement of waste treatment and disposal focusing on a reduction in the pollution abatement and pressure created by human activities in jeopardised areas to assess potential impacts on the lives and health of people, flora and fauna, soil, water, air, climate and landscape, material and cultural assets, and the interactions of such factors, as well as to identify and propose measures to prevent, mitigate or eliminate potential negative impacts.

Within the SEA, objectives of sustainable development and indicators for assessing the sustainability of INECP were defined. The indicators were in their majority selected from the basic set of sustainable development indicators of the UN and adapted to the specifics of this document. This set of indicators is based on the principle of identifying "causes" and "effects" and defining "responses" that would minimize environmental impacts. The evaluation process includes measures and policies in the field of electricity production from fossil fuels and RES, district heating systems and electricity transmission and distribution systems, natural gas distribution systems, coal production systems, energy efficiency measures in residential buildings, industrial and transport sector and energy measures and incentives in the sector of electricity production and RES (based on scenarios WEM and WAM), which are evaluated.

Matrices were developed in which the evaluation of defined priority activities was carried out according to defined objectives/indicators, impact assessment criteria and guiding questions.

This was followed by an assessment of the potential cumulative and synergistic effects of priority activities.

The impacts on the environmental objectives are presented in the summary matrix below.

Evaluation symbols of the Strategic Environmental Assessment

- **Negative** Impact	■
0 **Neutral** Impact	0
? Unknown	?
+/- **Mixed** Impact	■
+ **Positive** Impact	■

Table 10.1: Specific environmental objectives of SEA

No.	Specific objectives of the SEA	No.	Specific objectives of the SEA
SEO 01.1	Increased share of RES energy in BFPE at least 35.9 % in 2030	SEO 04.2	Sustainable use of water
SEO 01.2	Increasing energy efficiency and reduction of final consumption	SEO 04.3	Protection and sustainable use of agricultural and forest land
SEO 01.3	Reduction of energy consumption in transport	SEO 05.1	Preservation of biodiversity
SEO 01.4	Promotion of circular economy	SEO 05.2	Preservation of areas with nature protection status
SEO 02.1	Reduction of air emission, including GHG emissions, by 40.3% in 2030 compared to 1990	SEO 06.1	Preservation of the state of cultural heritage sites and archaeological remains
SEO 02.2	Ensured supply of adequate and healthy drinking water to the population	SEO 07.1	Preservation of exceptional landscapes, areas of national recognition and recognizable and typological characteristics of the landscape
SEO 02.3	Reduction of noise and vibrations pollution	SEO 08A.1	Ensure economic and social stability
SEO 02.4	Reduction of electromagnetic radiation	SEO 08B.1	Increase of investments in energy infrastructure and environmental protection
SEO 02.5	Reduction of generated waste and improved treatment and disposal of waste	SEO 08B.2	Improvement of institutions and personnel for environmental protection and climate change monitoring
SEO 03.1	Prevention of natural and anthropogenic-technological disasters.	SEO 08B.3	Improvement of research, innovation and competitive employment
SEO 04.1	Improved status or ecological potential of bodies of water, including surface water and groundwater		

Table 10.2: Summary of evaluation

		Thematic area of INECP						
		Decarbonisation						
Area of SEA	No. of specific objective	Reduction of GHG emission	RES	Energy efficiency	Energy security	Internal energy market	Research, innovation and competitiveness	Overall by SEA areas
1. Climate Change	SEO 01.1	🟩🟩	🟩🟩	🟩🟩	0	🟩	🟩	🟩🟩🟩🟩🟩🟩🟩🟩
	SEO 01.2	🟩	🟩🟩	🟩🟩	0	🟩	🟩	🟩🟩🟩🟩🟩🟩🟩
	SEO 01.3	🟩	🟥	🟩	0	?	🟩	🟥🟩🟩🟩?
	SEO 01.4	🟩	🟩	🟩	0	0	🟩	🟩🟩🟩🟩
2. Human Health and Quality of Life	SEO 02.1	🟩🟩	🟩🟩	🟨	🟥	🟥	🟩	🟥🟥🟨🟨🟩🟩🟩🟩
	SEO 02.2	🟩	🟥	🟥	🟥	🟥	🟩	🟥🟥🟥🟥🟩🟩
	SEO 02.3	0	🟨	🟨	🟥	🟥	🟩	🟥🟥🟨🟨🟩
	SEO 02.4	0	🟥	0	🟥	🟥	0	🟥🟥🟥
	SEO 02.5	🟩🟩	🟨	🟨	🟥	🟥	🟩	🟥🟥🟨🟨🟩🟩🟩
3. Natural and other disasters	SEO 03.1	🟩	🟥	🟨	🟨	🟥	?	🟥🟥🟨🟨🟩?
4. Sustainable management of natural resources	SEO 04.1	🟩	🟨	🟥	🟥	🟥	🟩	🟥🟥🟥🟨🟩🟩
	SEO 04.2	🟩	🟨	🟥	🟥	🟥	🟩	🟥🟥🟥🟨🟩🟩
	SEO 04.3	🟩	🟨	🟨	🟨	🟨	🟩	🟨🟨🟨🟨🟩🟩
5. Nature	SEO 05.1	🟩	🟥	🟨	🟥	🟥	🟩	🟥🟥🟥🟨🟩🟩
	SEO 05.2	🟩	🟨	🟨	🟨	🟨	🟩	🟨🟨🟨🟨🟩
6. Cultural heritage	SEO 06.1	0	🟨	🟨	🟨	🟨	0	🟨🟨🟨🟨
7. Landscape	SEO 07.1	0	🟥	🟥	🟥	🟥	0	🟥🟥🟥🟥
8. Socio-economic aspects	SEO 08A.1	🟩🟩	🟩🟩	🟩🟩	🟩🟩	🟩🟩	🟩	🟩🟩🟩🟩🟩🟩🟩🟩🟩🟩🟩
	SEO 08B.1	🟩🟩	🟩🟩	🟩🟩	🟩🟩	🟩	🟩🟩	🟩🟩🟩🟩🟩🟩🟩🟩🟩🟩🟩
	SEO 08B.2	🟩🟩	🟩🟩	🟩🟩	🟩	🟩	🟩🟩	🟩🟩🟩🟩🟩🟩🟩🟩🟩🟩
	SEO 08B.3	🟩	🟩	🟩	🟩	🟩	🟩🟩	🟩🟩🟩🟩🟩🟩🟩

Overall, the majority of impacts of the proposed INECP are assessed as positive.

The most **significant positive impacts** are identified at the level of the SEA areas:

- Climate Change
- Socio-economic impacts

Indicatively, positive impacts include:

- environmental quality: reduced GHG emissions due to increased use of renewable energy sources (RES) and application of clean technologies in thermal power plants in accordance with the Law on IPPC (integrated pollution prevention and control), further development of national legislation in accordance with international obligations and EU regulations;
- The implementation of a wide set of energy efficiency measures will contribute to more rational energy consumption, the development of legal norms in accordance with international obligations and EU regulations, and their application through an improved institutional framework will create preconditions for reducing pollution;
- Improving the quality of the environment thanks to afforestation, the use of new technologies in agriculture and a significant improvement of waste management particularly through increased recycling and composting as a share of total treated waste in the territory of Serbia;
- Socio-economic development: energy development which supports economic growth, definition of energy and fuel prices on market principles, development of local industry and applied scientific research sfor the transfer of the most modern technologies in the field of energy, strict implementation of energy efficiency measures in final energy consumption, mobility of the labour force on the market, as well as the overall development of the energy sector, will in the long term significantly contribute to the overall sustainable economic development of society and the rational use of non-renewable energy sources, as well as to an increase in the share of the use of greener energy sources. Also, scenario S in the sectors of forestry, agriculture and waste management (by promoting circular economy) will contribute to a significant improvement in the quality of life and wellbeing of the population and the creation of new jobs in these economic sectors.

Principal **negative impacts** include impacts linked to the construction stages of infrastructure as well the potential impact below:

- Impacts linked to RES (modern solar power plants and wind farms), where one can expect change of land uses for large areas of land, significant amounts of E-waste after the use of solar panels, electric shock, lightning strike, fire, etc. Construction of large solar power plants involves occupying a considerable area of land. If infrastructure is placed on natural habitats, loss, fragmentation and degradation of ecosystems can occur, which can have a negative impact on flora and fauna that are associated with those habitats. Large solar power plants can represent barriers to animal movement, especially if they are positioned in places that represent parts of migration corridors, which can hinder access to food, water and adequate habitats, as well as the passage of mating partners. In this way, a decrease in numbers and genetic isolation of populations can occur in the absence of preventive or mitigation measures. Solar power plants can also affect the microclimatic conditions in the immediate surroundings. Installing solar panels can also create shade and change the temperature and water regime of the habitat. These changes can have consequences for flora and fauna, especially if they are not considered at the stages of planning and construction.

- Regarding wind power plants, potential negative impacts on the protected ornitofauna and chiropterofauna are possible. In addition, since wind turbine propellers are made of composite materials, it is necessary to consider the problem of propellers at the end of their life.
- In the electrification of transportation, larger amounts of used batteries are expected.
- Certain negative implications could also be expected due to the construction of large HPPs, the construction of which could have a negative impact on the hydrological regime of the watercourses where construction is planned, biodiversity and ichthyofauna, and a possible change in the use of agricultural and forest land.
- Potential impacts linked to the construction of a large number of small hydropower plants on one watercourse. For such interventions, guidelines for lower hierarchical levels of planning are set forward which propose the preparation of certain planning documents and project impact assessments, so that for each specific location for which a change of use is expected, the positive and negative impacts of these interventions on the environment are evaluated.
- Potential impacts linked to the construction of a considerable number of infrastructure projects (interconnection projects, gas pipelines and interconnections, etc) which are expected to be of regional/local character, temporary and reversible with proper environmental management., short-term and

The implementation of the relevant legal and regulatory framework in place, responsible planning and implementation of actions in line with international best practices and applying preventive and mitigation measures as outlined in the SEA and/or future EIAs are expected to significantly reduce any negative impacts.

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